CDC PUBLIC HEALTH GRAND ROUNDS

Be Antibiotics Aware: Smart Use, Best Care

Accessible version: https://www.youtube.com/watch?v=Bb75IZgftCk

May 15, 2018

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Continuing Education Information

- **Continuing education:** **www.cdc.gov/getce**
  - After creating a TCEO account, click the “Search Courses” tab on the left and use “Public Health Grand Rounds” as a keyword search.
  - All PHGR sessions eligible for CE should display, select the link for today’s session and then Continue button. Course Access Code is **PHGR10**.
  - CE expires June 18, 2018 for live course and June 19, 2020 for Web On Demand course.
  - Issues regarding CE and CDC Grand Rounds, email: **ce@cdc.gov**

Continuing Education Information (continued)

CDC, our planners, our presenters and their spouses/partners wish to disclose they have no financial interests or other relationships with the manufacturers of commercial products, suppliers of commercial services, or commercial supporters with the exception of Dr. Linder, who wishes to disclose stock in Amgen, Biogen, and Eli Lily. The planning committee discussed conflict of interest with Dr. Linder to ensure there is no bias. Content of the presentation will not include any discussion of the unlabeled use of a product or a product under investigational use. CDC did not accept commercial support for this continuing education activity.

Public Health Grand Rounds Resources

Send comments or questions to:

grandrounds@cdc.gov

youtube.com/user/CDCStreamingHealth

Access full PHGR sessions & Beyond the Data

facebook.com/CDC

Like CDC's Facebook page to stay informed on all things public health

Visit our website at:

www.cdc.gov/grand-rounds

Additional Resources

Beyond The Data

“Take home” messages in a short video at: cdc.gov/grand-rounds

scienceclips CDC

Centers for Disease Control and Prevention
STEPHEN B. THACKER CDC LIBRARY

Scientific publications about this topic at: cdc.gov/library/sciclips

Email grandrounds@cdc.gov with any questions or for help locating the additional resources

Today's Speakers and Contributors

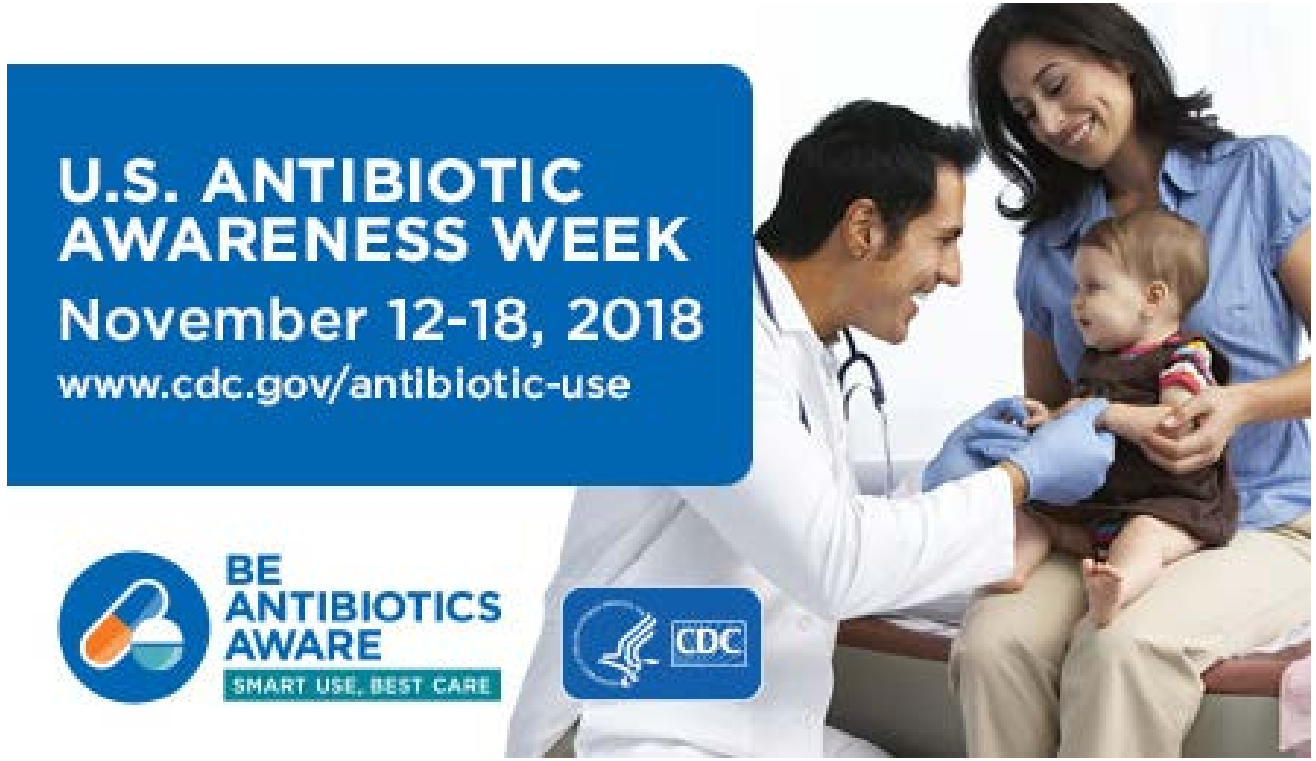
Katherine Fleming-Dutra
MD, FAAP

Jeffrey Linder
MD, MPH, FACP

David Hyun
MD

Acknowledgments

- BEARI Team
- Austyn Dukes
- Paula Eriksen
- Shannon Graham
- Lauri Hicks
- Brenda Holmes
- Marinda Logan
- Luis Luque
- Alicia May
- Ateev Mehrotra
- Chaity Naik
- Kelly O'Neill
- Meredith Reagan
- Michelle Walker
- Courtney Ware



www.cdc.gov/antibiotic-use

Be Antibiotic Aware: Smart Use, Best Care




U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

The Case for Antibiotic Stewardship

Katherine Fleming-Dutra, MD, FAAP

Deputy Director, Office of Antibiotic Stewardship

Division of Healthcare Quality Promotion

Centers for Disease Control and Prevention

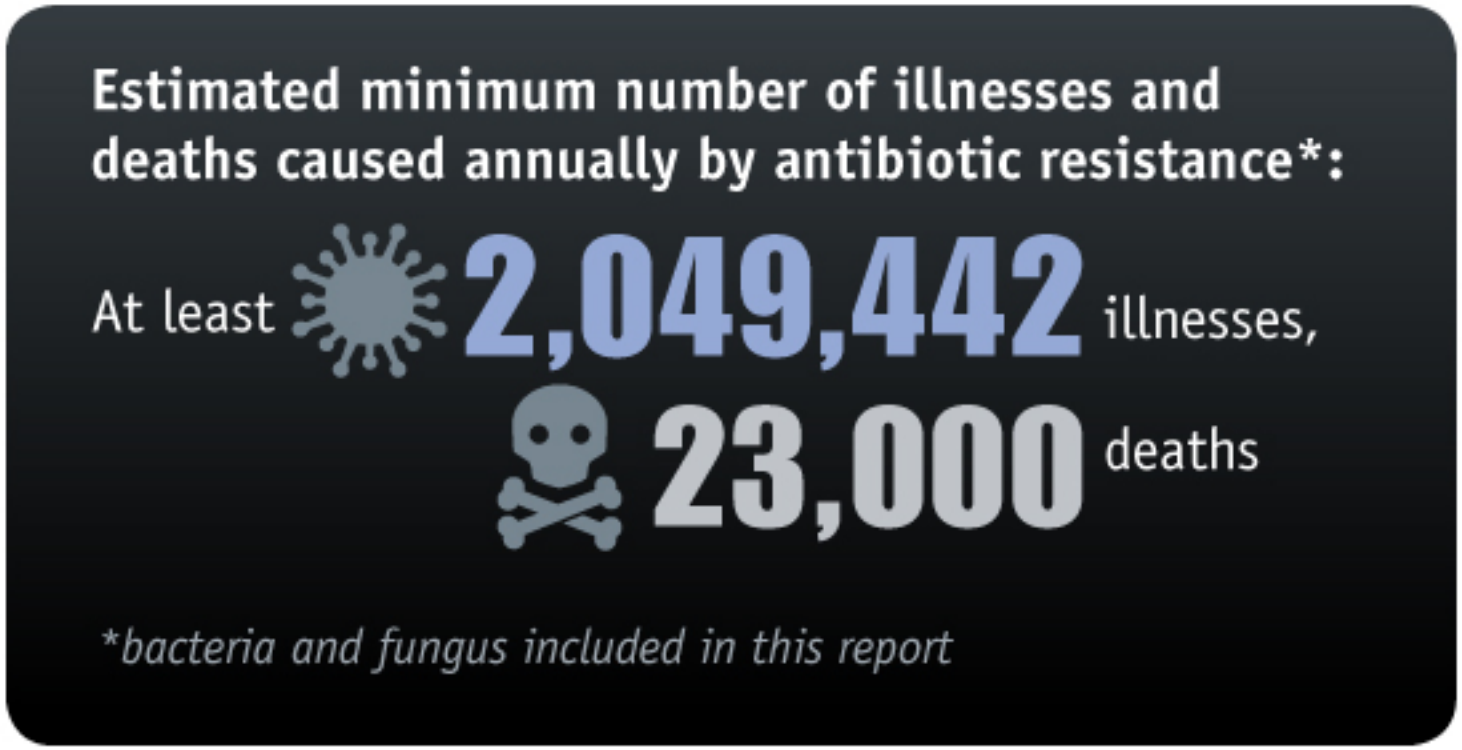
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Life-saving Benefits of Antibiotics

- **Once deadly infectious bacterial diseases are treatable**

- **Important adjunct to modern medical advances**
  - Surgeries
  - Transplants
  - Cancer chemotherapies

Antibiotic Resistance



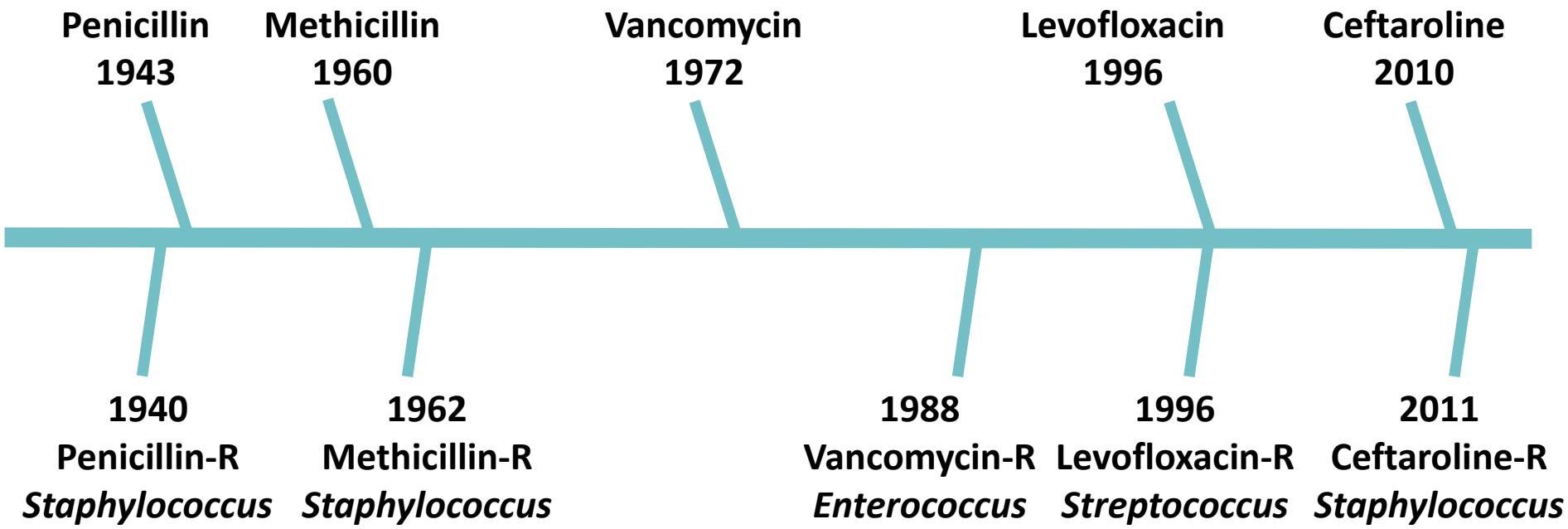
Annual excess direct healthcare cost: $20 billion

Additional annual cost of lost productivity: >$35 billion

www.cdc.gov/drugresistance/threat-report-2013/

Antibiotic Use Drives Resistance

Date of Antibiotic Market Introduction



Date Resistance Identified

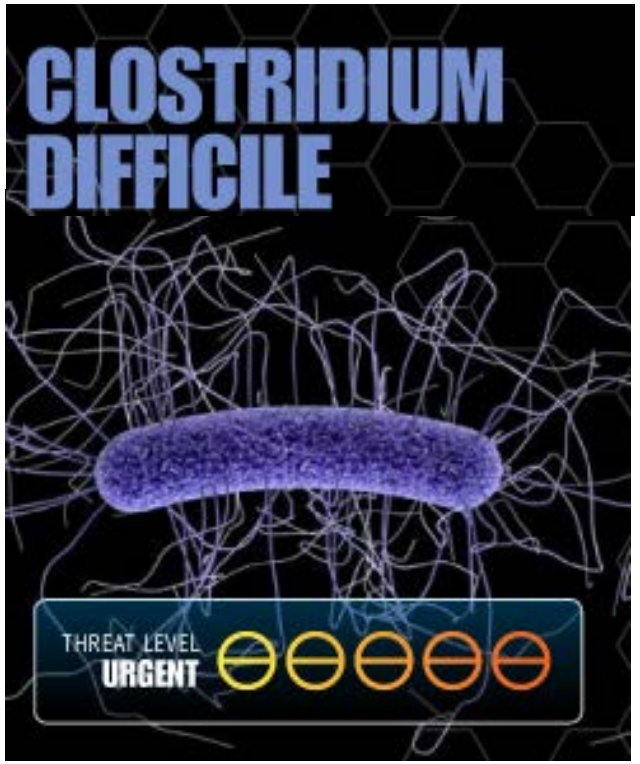
www.cdc.gov/drugresistance/about.html

Unintended Consequences of Antibiotic Use: Adverse Events

- Adverse events range from minor to severe
- 200,000 emergency department visits occur nationally per year from antibiotic-associated adverse events
- Antibiotic use associated with allergic, autoimmune, and infectious diseases likely through disruption of the normal microbiome

Linder JA. *Clin Infect Dis.* 2008 Sep 15;47(6):744–6
Shehab N, Lovegrove MC, Geller AI, et al. *JAMA* 2016:316:2115–25
Vangay P, Ward T, Gerber JS, et al. *Cell Host Microbe* 2015 May 13; 17(5): 553–564

Clostridium Difficile Infection: Consequence of Antibiotic Use

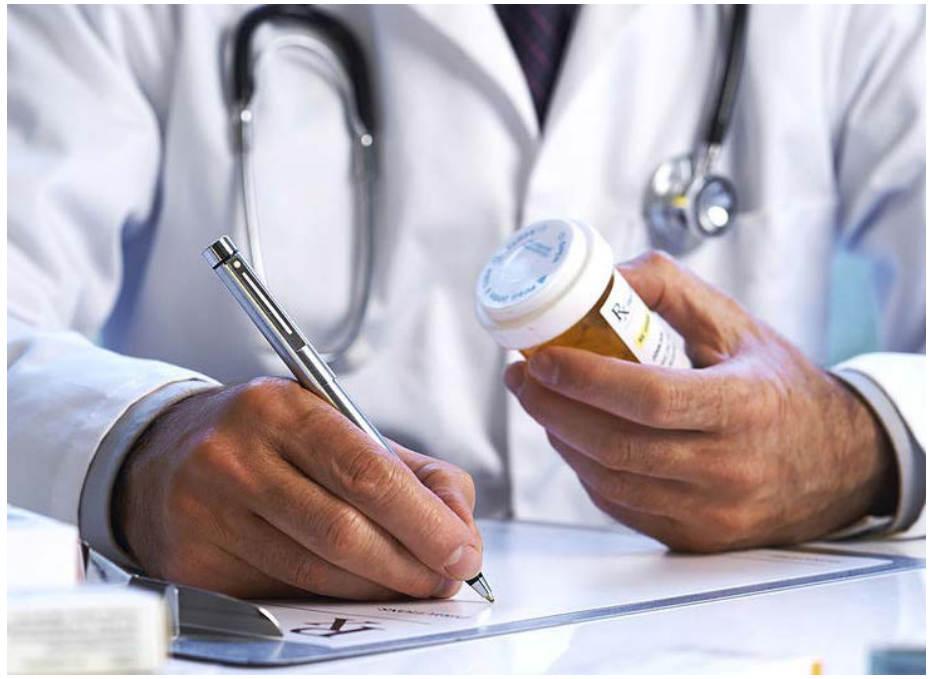


- **453,000 infections and 15,000 deaths in the United States annually**
- ***C. difficile* infections can be recurrent and are costly and potentially fatal consequences of antibiotic use**
- **Prevention of *C. difficile* infections is key**

Lessa FC, Bamberg WM, Beldavs ZG, et al. *N Engl J Med.* 2015 Feb 26;372(9):825–34

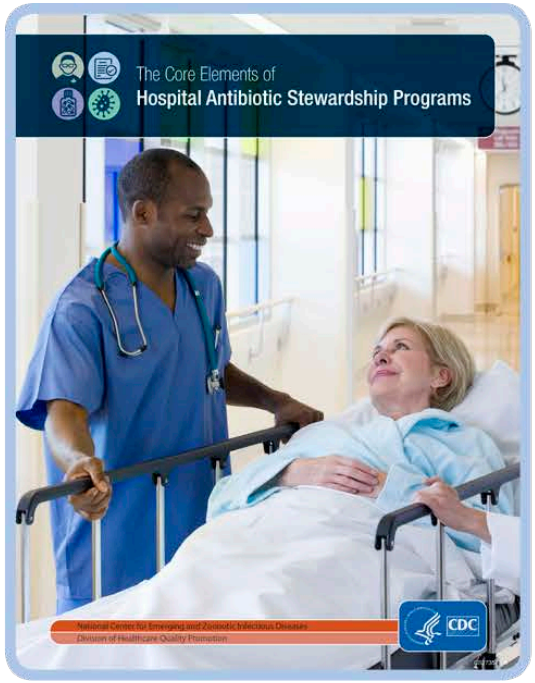
Antibiotic Stewardship

- **Antibiotic stewardship is the effort to:**
  - Measure antibiotic prescribing
  - Improve antibiotic prescribing so that antibiotics are prescribed and used only when needed
  - Ensure prompt initiation of antibiotics when they are needed
  - Ensure that the right drug, dose, and duration are selected when an antibiotic is needed

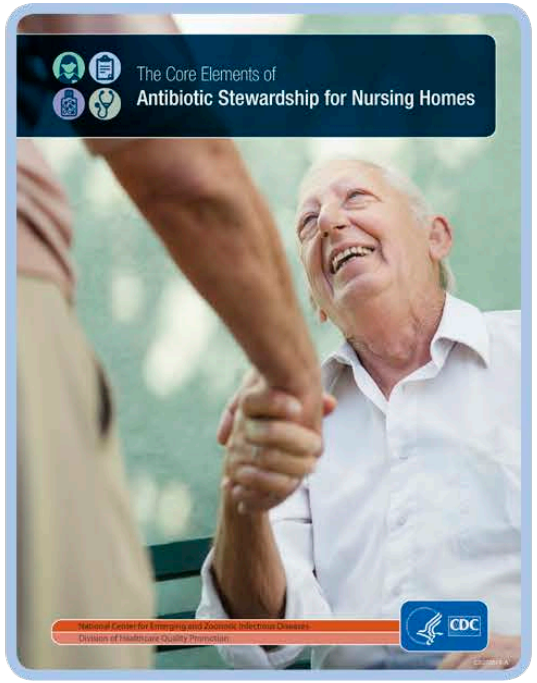


It’s about patient safety and delivering high-quality health care.

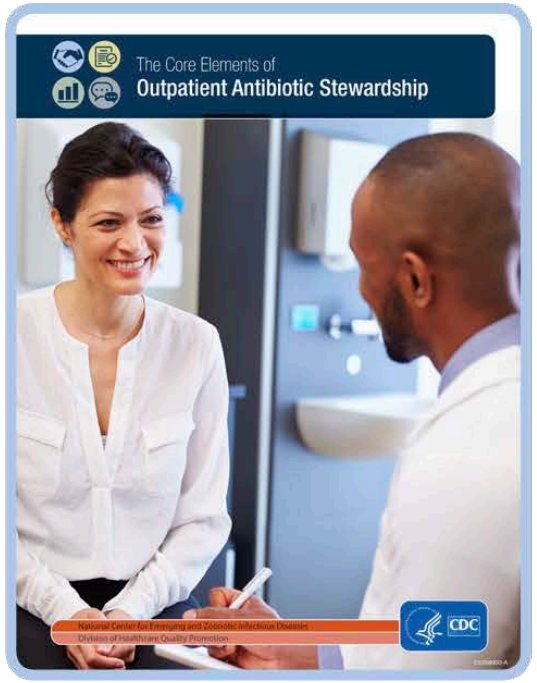
CDC's Core Elements of Antibiotic Stewardship



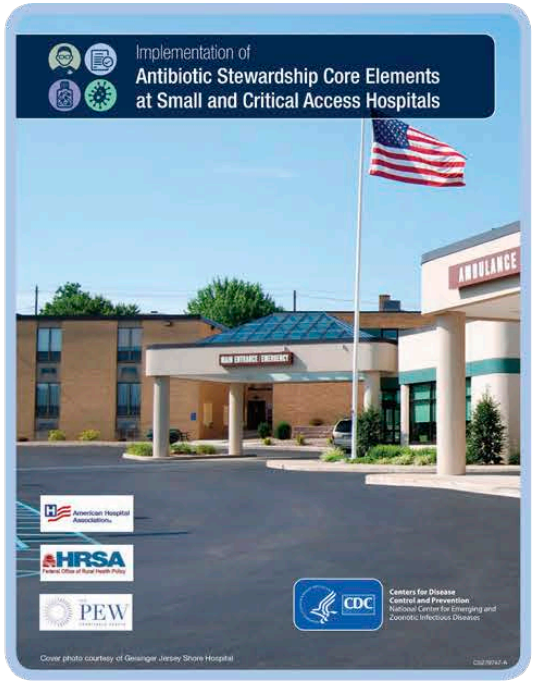
2014



2015



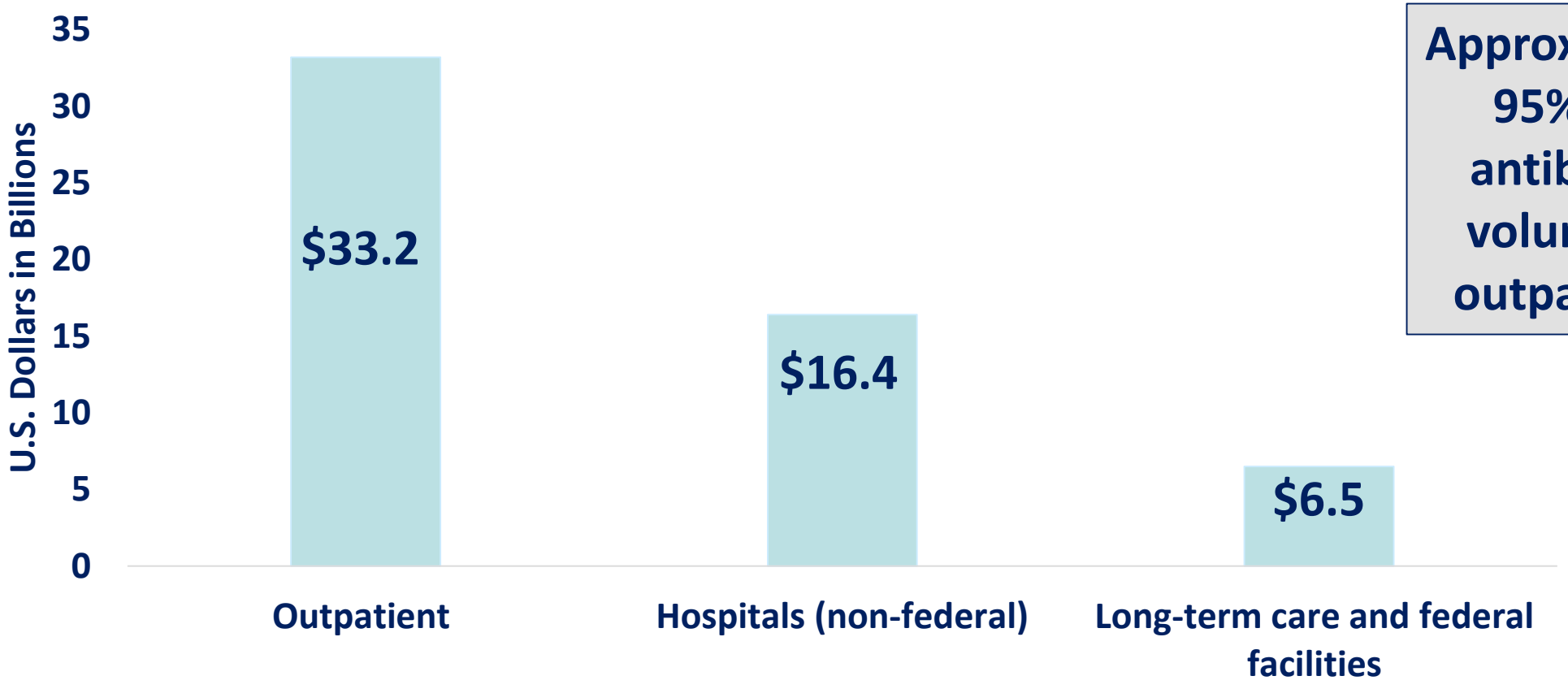
2016



2017

www.cdc.gov/antibiotic-use/healthcare/implementation/core-elements.html www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html
www.cdc.gov/antibiotic-use/healthcare/implementation/core-elements-small-critical.html
www.cdc.gov/antibiotic-use/community/improving-prescribing/core-elements/core-outpatient-stewardship.html

Antibiotic Expenditures for Humans by Treatment Setting from 2010–15: $56.0 Billion



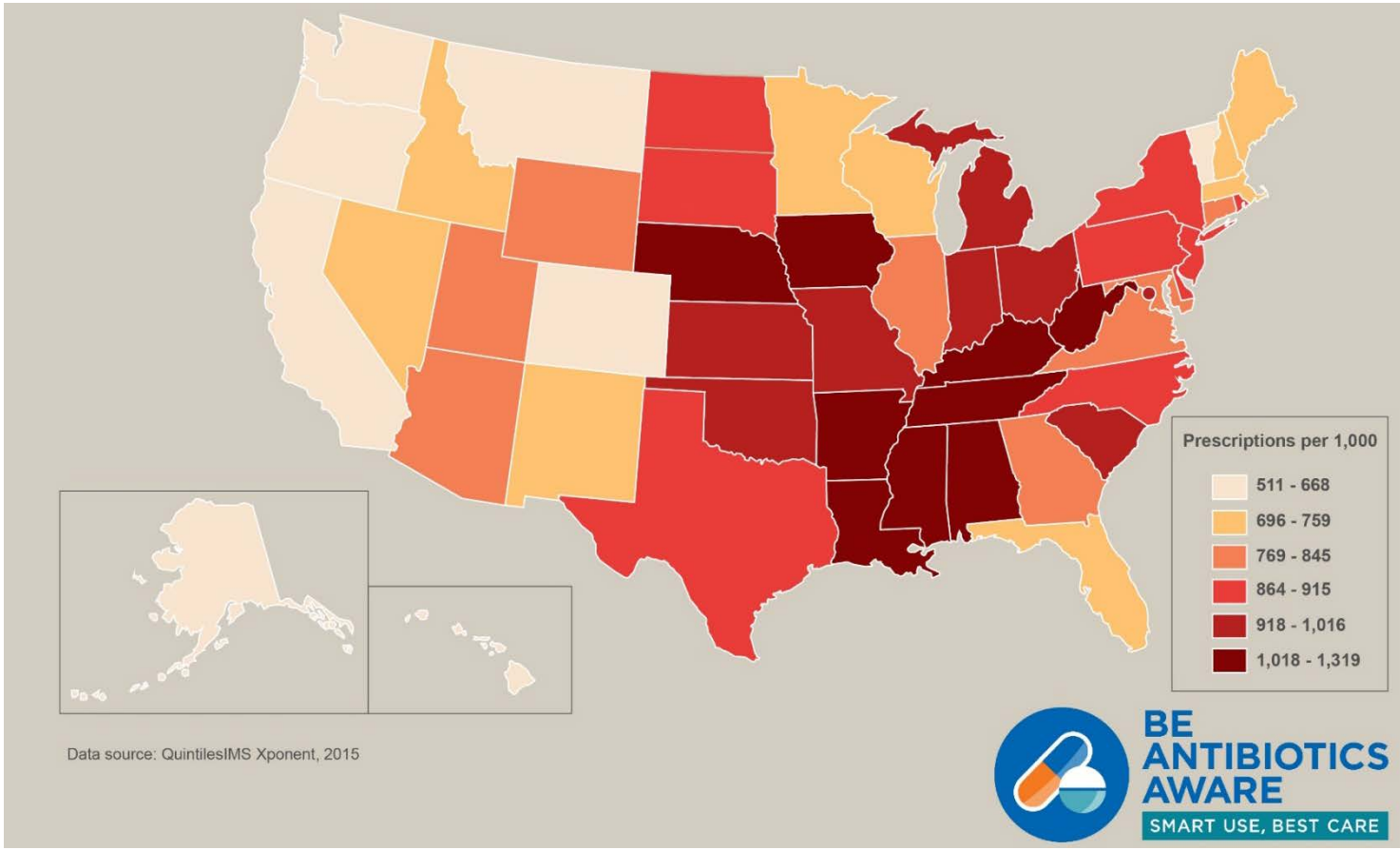
Approximately 85%–95% of human antibiotic use by volume occurs in outpatient setting

Figure created from data from: Suda K, Hicks L, Roberts R, et al. *Clin Infect Dis*. 2018 Jan;66(2):185–190

Duffy E, Ritchie S, Metcalfe S, et al. *J Clin Pharm Ther*. 2018 Feb;43(1):59–64

270 Million Antibiotic Prescriptions Dispensed in U.S. Outpatient Pharmacies, 2015

Outpatient Antibiotic Prescriptions per 1,000 Population, 2015



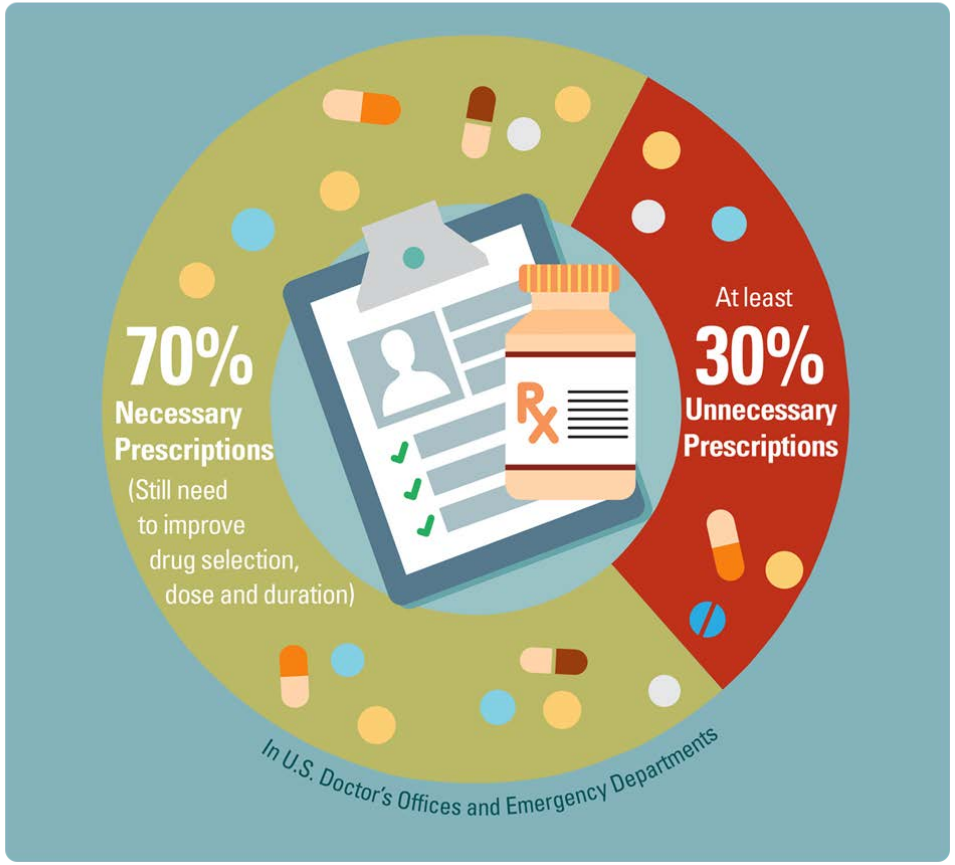
www.cdc.gov/antibiotic-use/community/programs-measurement/state-local-activities/outpatient-antibiotic-prescriptions-US-2015.html

National Goal for Improving Outpatient Antibiotic Use

- **2020 Goal: Reduce <u>inappropriate</u> antibiotic use by 50% in outpatient settings**

The White House (2015). National Action Plan for Combating Antibiotic-Resistant Bacteria. Washington.

National Goal for Improving Outpatient Antibiotic Use

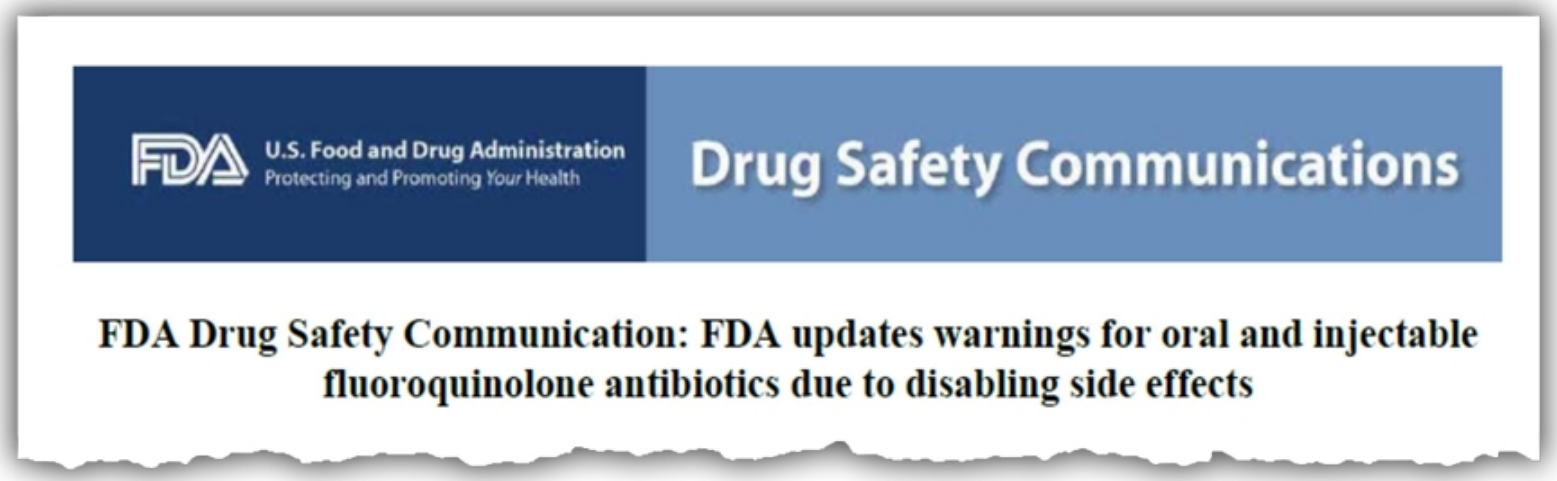


- **At least 30% of outpatient antibiotic prescriptions were unnecessary in 2010–11**
  - Respiratory infections (e.g., colds and bronchitis) were major drivers of unnecessary antibiotic use
- **National goal: Reduction of outpatient antibiotic use by 15% (half of the unnecessary 30%) by 2020**

Fleming-Dutra KE, Hersh AL, Shapiro DJ, et al. *JAMA* 2016 May 3;315(17):1864–73

Improve Antibiotic Selection

- **Adults with sinusitis who are prescribed antibiotics:**
  - 37% receive first-line antibiotics (amoxicillin with or without clavulanate)
  - 26% receive macrolides (e.g. azithromycin), which are not recommended
  - 16% receive fluoroquinolones, which have higher risk of adverse events


U.S. Food and Drug Administration
Protecting and Promoting *Your* Health

Drug Safety Communications

FDA Drug Safety Communication: FDA updates warnings for oral and injectable fluoroquinolone antibiotics due to disabling side effects

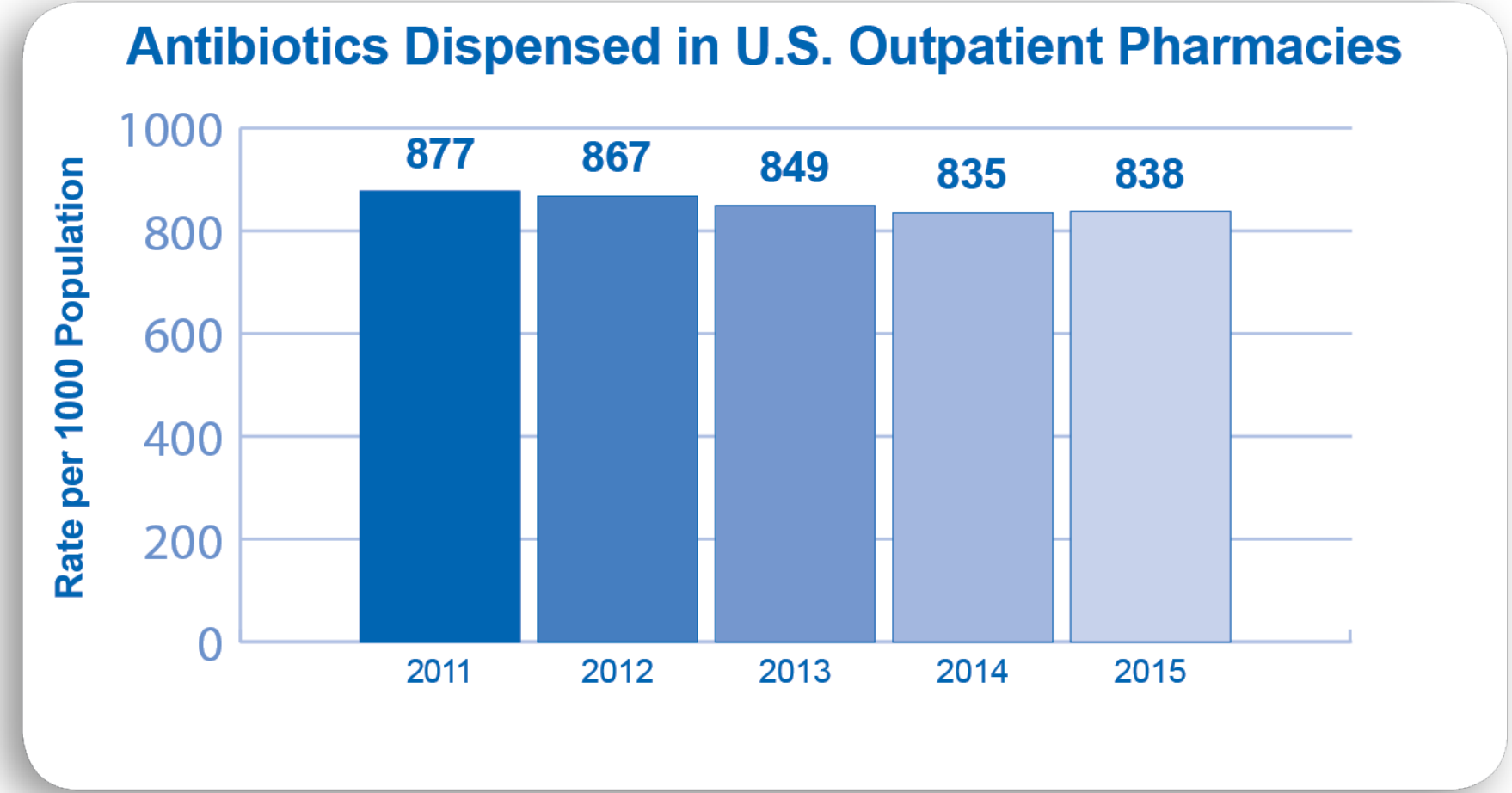
Hersh AL, Fleming-Dutra KE, Shapiro DJ, et al. *JAMA Intern Med*. 2016 Dec 1;176(12):1870–1872

www.fda.gov/Drugs/DrugSafety/ucm500143.htm

Chow AW, Benninger MS, Brook JL, et al. *Clin Infect Dis.* 2012 Apr;54(8):e72–e112

Rosenfeld RM, Piccirllo JF, Chandrasekhar SS, et al. *Otolaryngol Head Neck Surg*. 2015 Apr;152(2 Suppl):S1–S39

Are We Reducing Inappropriate Antibiotic Use?

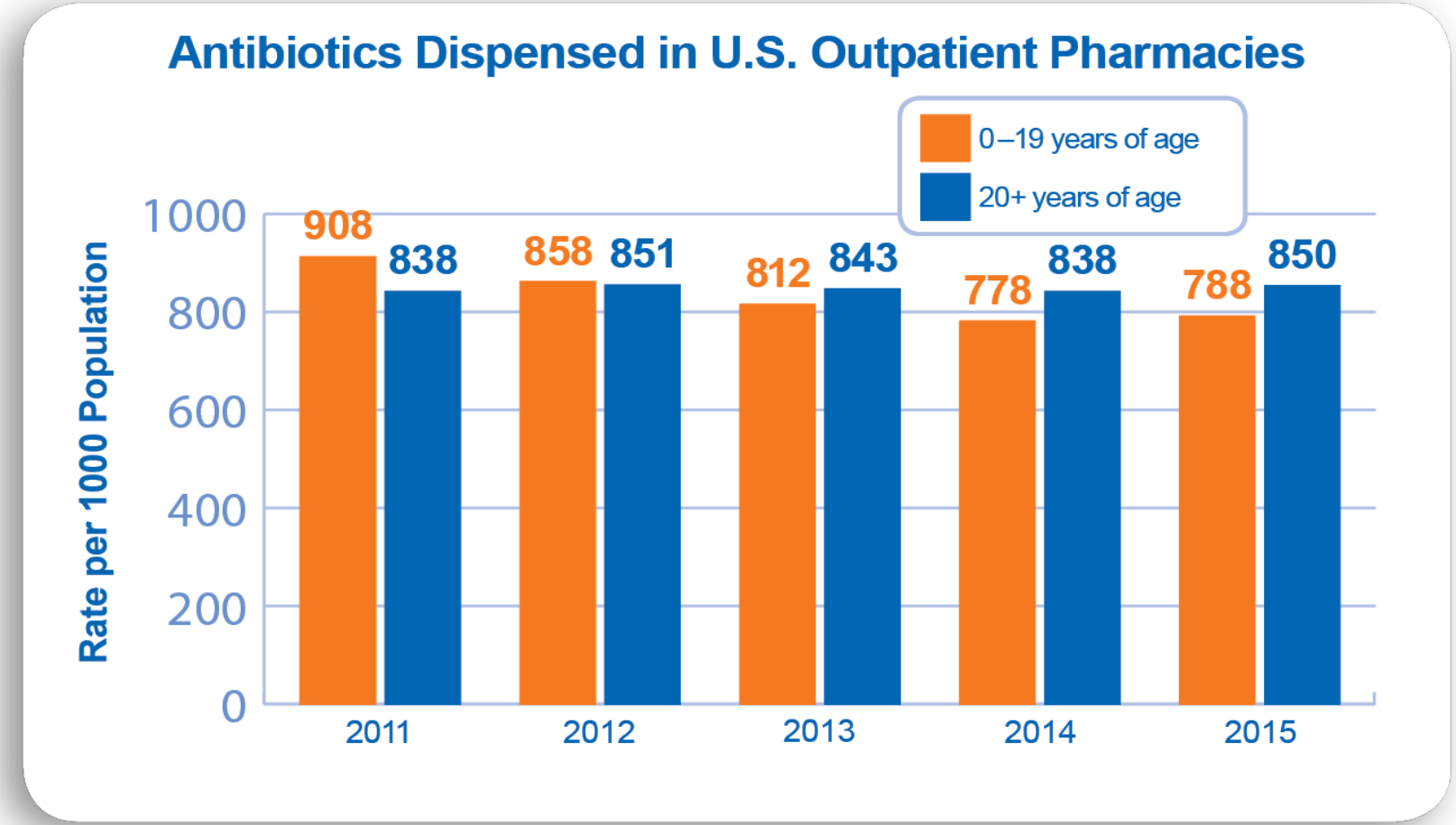


- Outpatient antibiotic prescribing rates have decreased by 4% 2011–2015
- National goal: Reduce outpatient antibiotic use by 15% by 2020

IQVIA pharmacy dispensing data

gis.cdc.gov/grasp/PSA/indexAU.html

Are We Reducing Inappropriate Antibiotic Use?



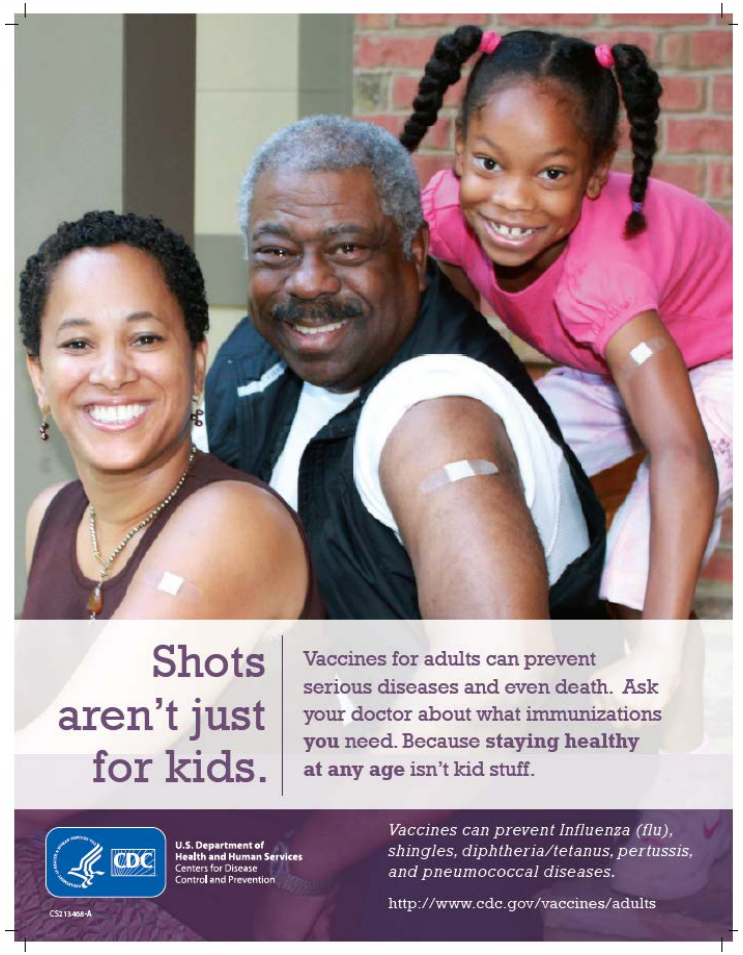
- Outpatient antibiotic prescribing rates to children decreased by 13%
- Outpatient antibiotic prescribing rates to adults have been stable

IQVIA pharmacy dispensing data

gis.cdc.gov/grasp/PSA/indexAU.html

Lessons Learned to Improve Antibiotic Use in Adults

- **Vaccines are key antibiotic stewardship tools**
  - Pneumococcal conjugate vaccine (PCV) recommended for young children since 2000 in United States
  - PCV led to decreases in pneumococcal infections
    - Common infections such as acute otitis media
    - Antibiotic-resistant pneumococcal infections
  - Preventing disease is the first step in improving antibiotic use and combating antibiotic resistance



Nuorti P. & Whitney C. *MMWR Rec Rep* 2010; 59(RR-11): 1–18

www.cdc.gov/flu/pdf/freeresources/updated/f-adults-shots.pdf

Lessons Learned to Improve Antibiotic Use in Adults

- **Public health and clinicians who care for children have worked together to improve antibiotic use**
  - Pediatric professional societies have incorporated antibiotic stewardship principles into guidelines
    - Watchful waiting before deciding whether antibiotics are needed for certain infections
    - Narrow-spectrum antibiotics as first-line therapies
  - CDC has led educational efforts to improve antibiotic use among children since 1995

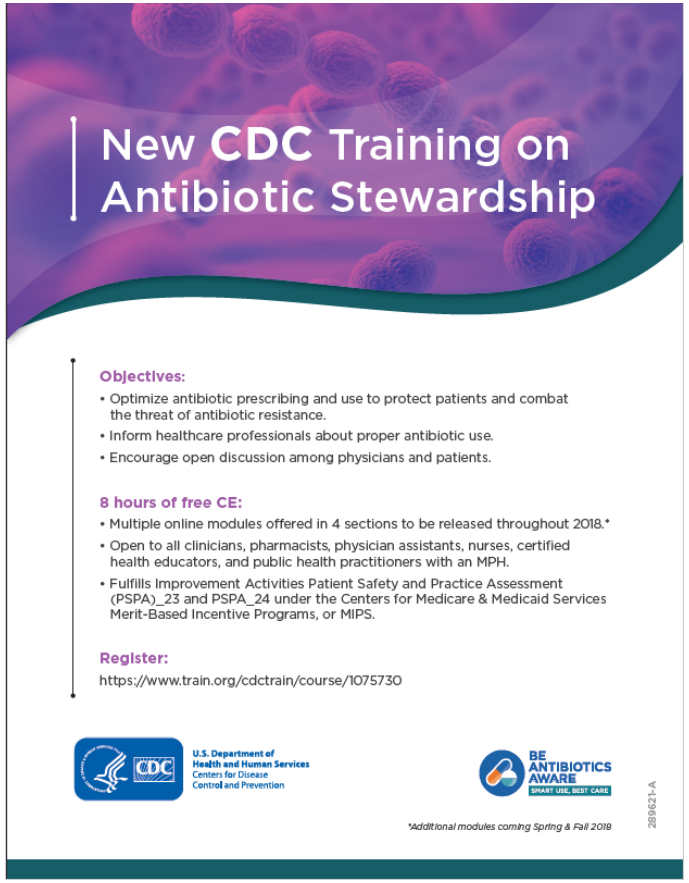
Lieberthal AS, Carroll AE, Chonmaitree T, et al. *Pediatrics* 2013 Mar;131(3):e964–99

Wald ER, Applegate KE, Bordley C, et al. *Pediatrics* 2013 Jul;132(1):e262–80

Bradley JS, Byington CL, Shah SS, et al. *Clin Infect Dis* 2011 Oct;53(7):e25–76

Be Antibiotics Aware: Smart Use, Best Care

- Increased messaging for adult patients
- New efforts to reach clinicians who care for adults



www.cdc.gov/antibiotic-use

www.train.org/cdctrain/course/1075730/compilation

Summary

- **Improving antibiotic use through antibiotic stewardship is a key strategy to combat antibiotic resistance and improve patient safety**

- **Outpatient setting accounts for the majority of human antibiotic use**
  - At least 30% of antibiotic prescriptions are unnecessary
  - We also can improve antibiotic selection, dosing, and duration
  - Antibiotic prescribing rates have decreased for children, but not for adults

- **We need to improve antibiotic prescribing to adult patients using the lessons learned from progress in children**

Improving Outpatient Antibiotic Prescribing for Adults

Jeffrey A. Linder, MD, MPH, FACP

Professor of Medicine and Chief

Division of General Internal Medicine and Geriatrics

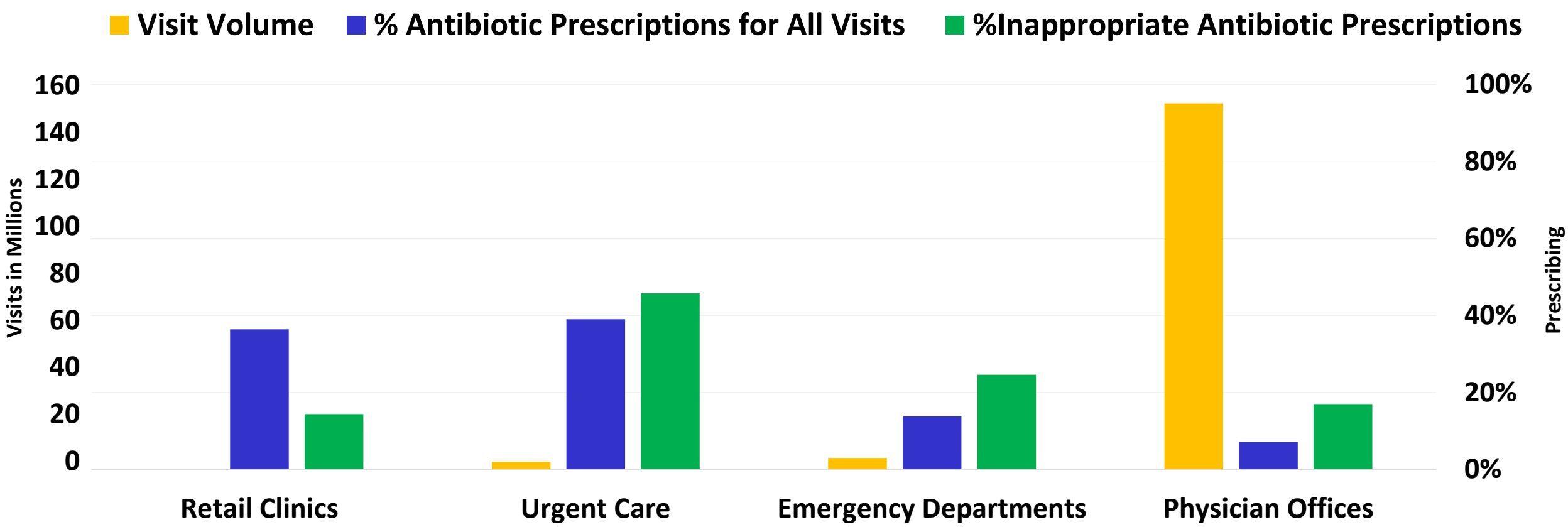
Northwestern University Feinberg School of Medicine

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Overview

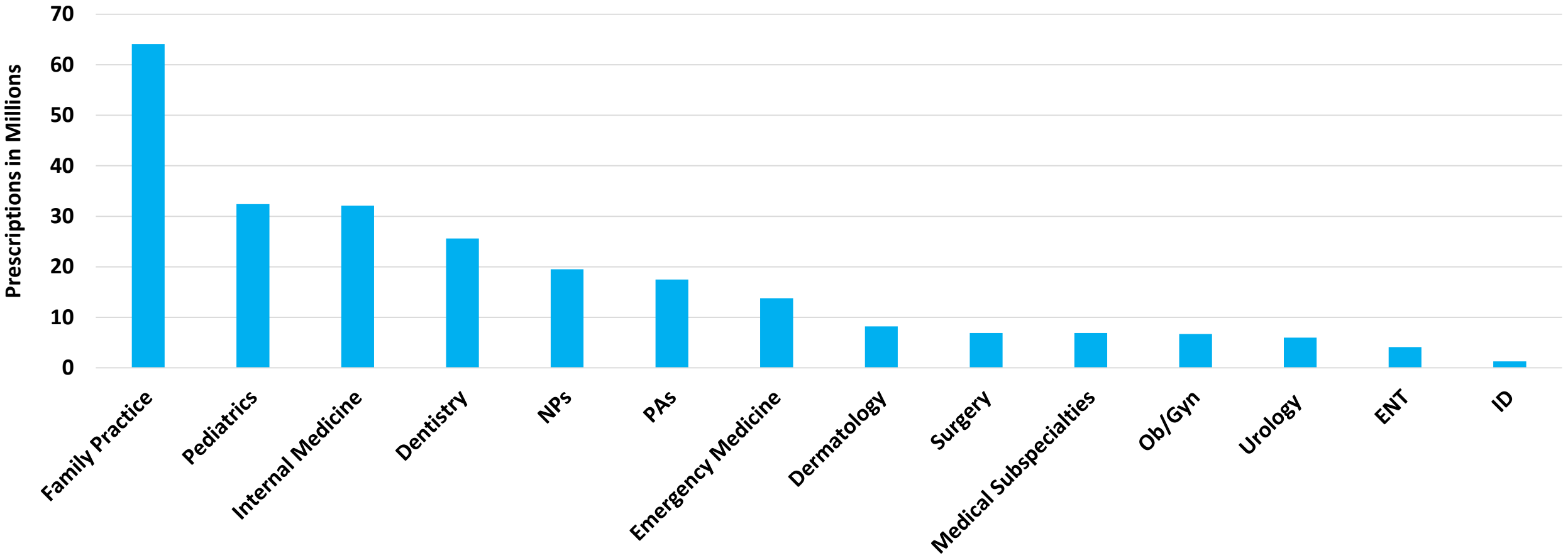
- **Targets for Improving Outpatient Antibiotic Use**
  - Where?
  - Who?
  - For What?
- **Insights from behavioral science, behavioral economics, and social psychology**

Targets: Where



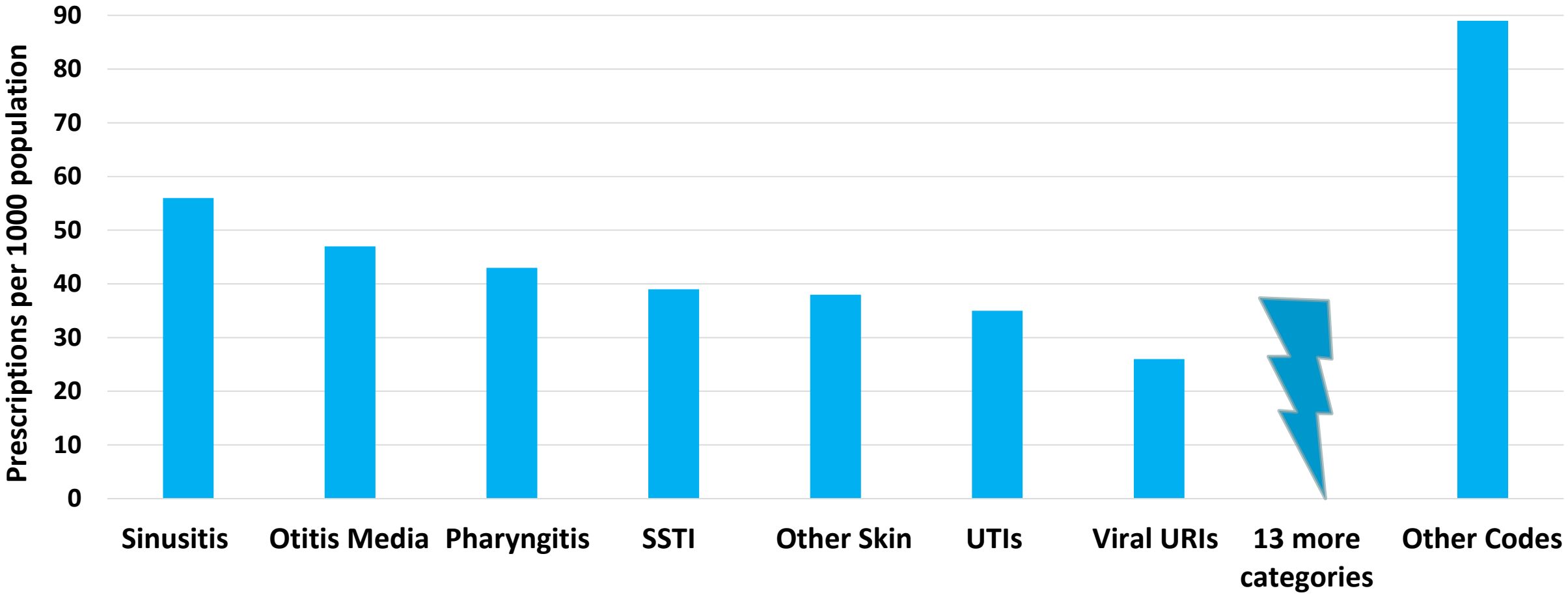
Palms D, Hicks L, Hersh AL, et al. *Open Forum Infectious Diseases*, 2014 Volume 4, Issue suppl_1, 1 October 2017, Pages S507

Targets: Who



Hicks LA, Bartoces MG, Roberts RM, et al. *Clin Infect Dis* 2015 May 1;60(9):1308–16

Targets: For What



Fleming-Dutra KE, Hersh AL, Shapiro DJ, et al. *JAMA* 2016 May 3;315(17):1864–73

Intervention Goals

- **What is your target?**
  - Where?
  - Who?
  - For What?
- **What are you hoping to accomplish?**
  - What is your goal?
- **What intervention will you use?**

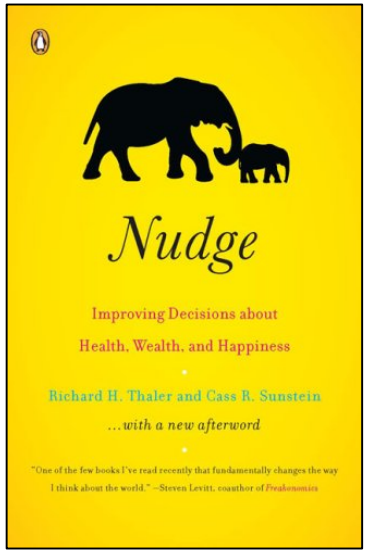
Trying to Change Prescribing Behavior

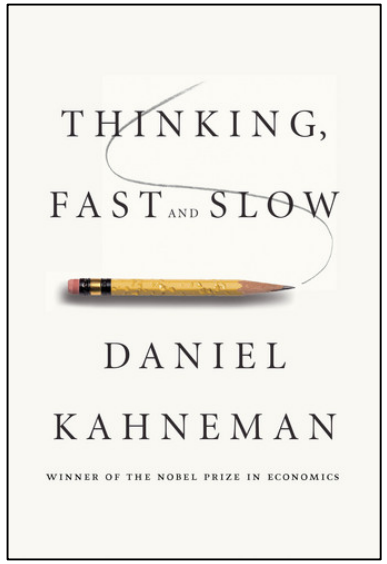
- **Limited success of prior interventions**

- **Implicit model: clinicians reflective, rational, and deliberate**
  - Educate and remind interventions

Changing Prescribing Behavior

- **Behavioral model: decisions fast, automatic, influenced by emotion and social factors**
  - Cognitive bias
  - Self-image preservation
  - Social motivation





Factors Driving Antibiotic Prescribing

Factors Driving Antibiotic Prescribing: Immediate and Emotionally Salient

- Belief that a patient wants antibiotics
- Perception that it is easier and quicker to prescribe antibiotics than explain why they are unnecessary
- Habit
- Worry about serious complications and "just to be safe" mentality

Factors Deterring Antibiotic Prescribing: More Remote and Less Emotionally Salient

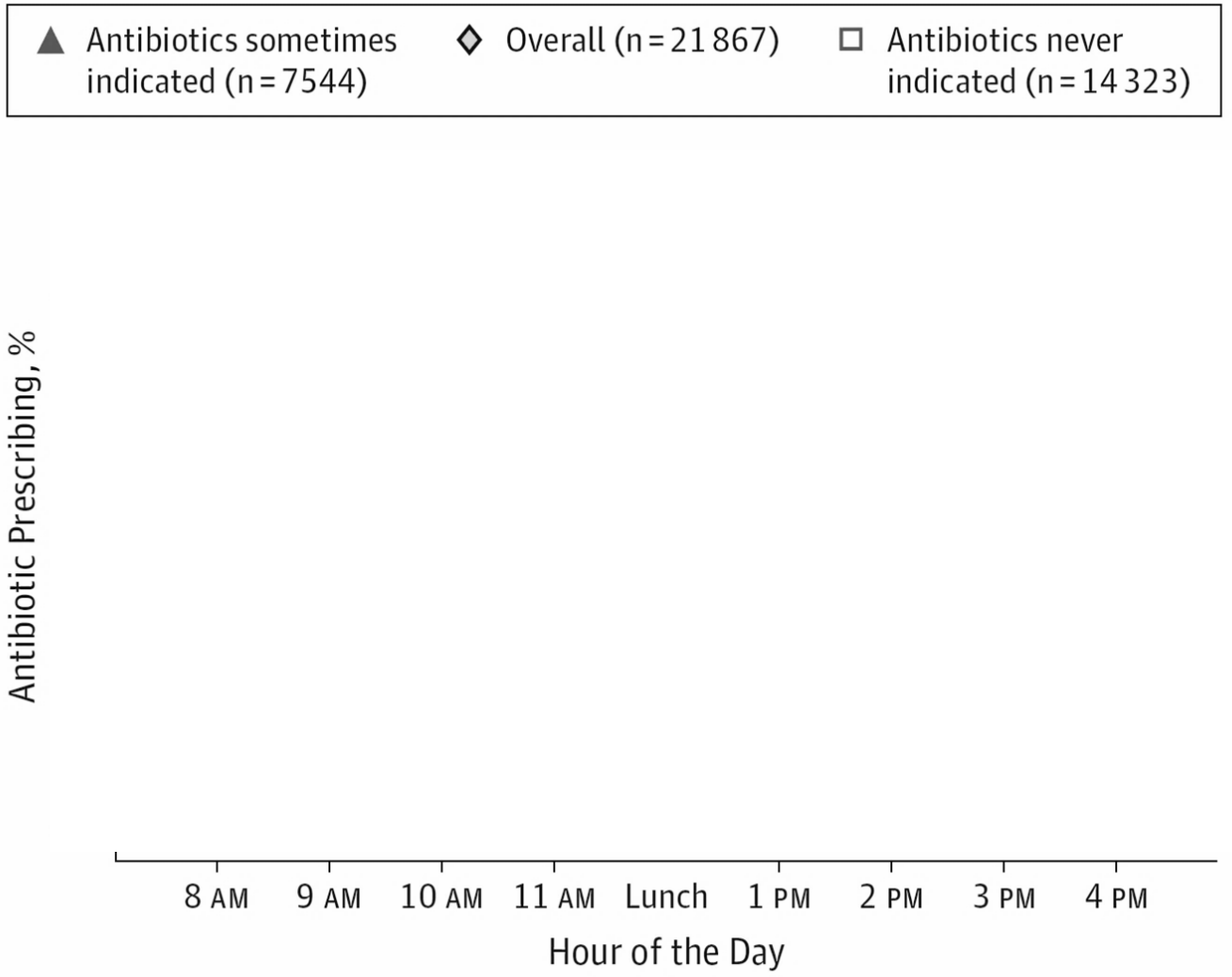
- Risks of adverse reactions and drug interactions
- Recognizing the need for antibiotic stewardship
- Desire to deter low-value care and decrease unnecessary health care spending
- Prefer to follow guidelines

Mehrotra A. & Linder JA. *JAMA Intern Med* 2016 Nov 1;176(11):1649–1650

Effective Behavior Change

- **Insights from behavioral science, behavioral economics, and social psychology**
  - Decision fatigue
  - Precommitment
  - Accountable justification
  - Peer comparison

Antibiotic Prescribing by Hour of the Day



Linder JA, Doctor JN, Friedberg MW, et al. *JAMA Intern Med* 2014 Dec;174(12):2029–31

Pre-commitment Poster

Safe Antibiotic Use:
A Letter From Your Medical Group

Dear Patient,

We want to give you some important information about antibiotics.

Antibiotics, like penicillin, fight infections due to bacteria that can cause some serious illnesses. But these medicines can cause side effects like skin rashes, diarrhea, or yeast infections. If your symptoms are from a virus and not from bacteria, you won't get better with an antibiotic, and you could still get these bad side effects.

Antibiotics also make bacteria more resistant to them. This can make future infections harder to treat. This means that antibiotics might not work when you really need them. Because of this, it is important that you only use an antibiotic when it is necessary to treat your illness.

How can you help? Carefully follow your doctor's
you should or should not take antibiotics.

When you have a cough, sore throat, or other illne
the best possible treatments. If an antibiot
doctor will explain this to you, and

Your health is very important to us. As your doctors, we promise to treat your illness in the best way possible. We are also dedicated to avoid prescribing antibiotics when they are likely to do more harm than good.

El Uso Seguro de Antibióticos:
Una Carta de su Grupo Médico

Estimado Paciente:

Queremos compartir información importante con usted sobre los antibióticos.

Los antibióticos como la penicilina ayudan a combatir infecciones debido a bacterias que pueden causar serias enfermedades. Pero estas medicinas también tienen efectos secundarios como erupciones de la piel, diarrea, o infecciones por hongos de levadura. Si sus síntomas son debidos a un virus y no por una bacteria, no se mejorará con un antibiótico, y usted aún puede obtener estos efectos secundarios no deseables.

Los antibióticos también pueden hacer la bacteria más resistente a ellas. Esto hará que infecciones en el futuro sean más difíciles de tratar. Eso significa que los antibióticos no trabajarán cuando ustedes en realidad necesitan que funcionen. Por

para su

á si

le
laño

que sean
mejor para usted.

Su salud es importante para nosotros. Como sus doctores, nosotros prometemos tratar su enfermedad en la mejor manera posible. También nos comprometemos a

Your health is very important to us. As your doctors, we promise to treat your illness in the best way possible. We are also dedicated to avoid prescribing antibiotics when they are likely to do more harm than good.

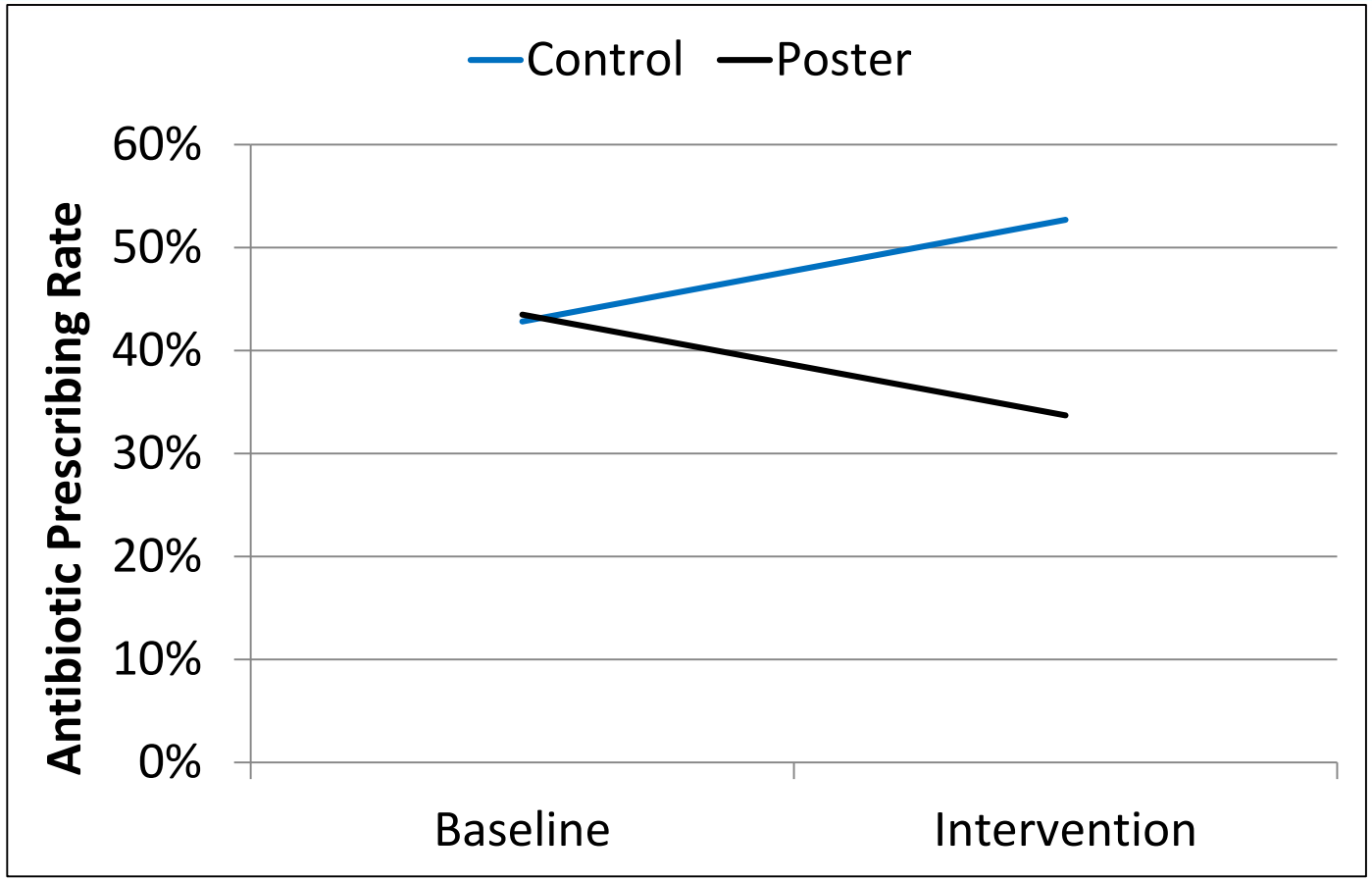
Meeker D, Knight TK, Friedberg MW, et al. *JAMA Intern Med.* 2014 Mar;174(3):425–31

Pre-commitment Poster: Methods

- **Randomized 14 clinicians**
  - Stratified by high-and low-prescribing
- **48-week baseline**
- **12-week intervention**
- **954 non-antibiotic-appropriate acute respiratory infection visits**

Meeker D, Knight TK, Friedberg MW, et al. *JAMA Intern Med* 2014 Mar;174(3):425–31

Pre-Commitment Poster: Results



Adjusted difference-in-differences: -20% (-6% to -33%)

Meeker D, Knight TK, Friedberg MW, et al. *JAMA Intern Med* 2014 Mar;174(3):425–31

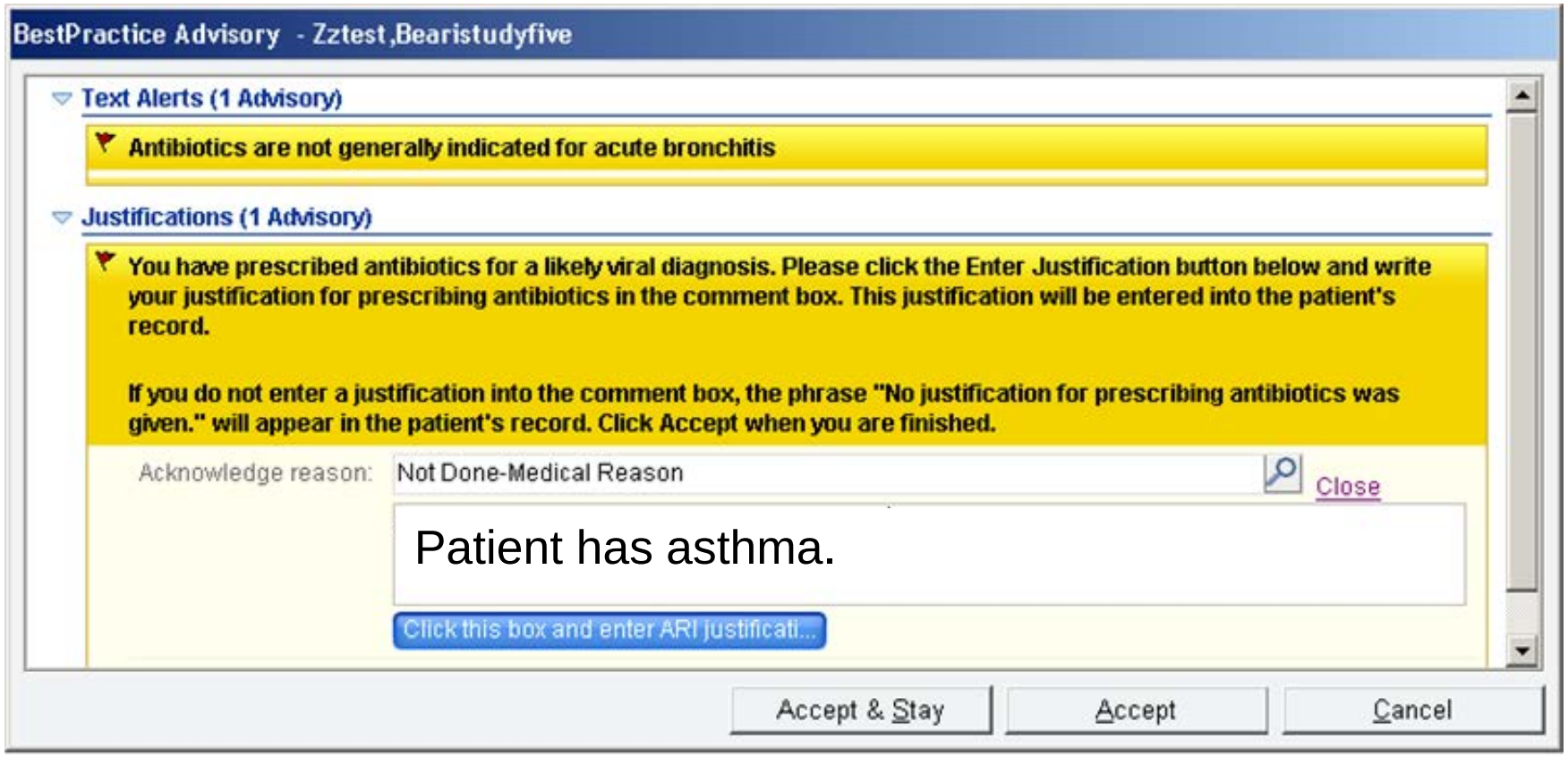
Commitment Posters

- **CDC Core Elements of Outpatient Stewardship (2017)**
- **EU Draft Guidelines for Antibiotic Stewardship**
  - Illinois Department of Public Health
  - New York State Department of Health

New York State Department of Public Health Commissioner

EU: European Union

Accountable Justification



Meeker D, Linder JA, Fox CR, et al. *JAMA* 2016 Feb 9;315(6):562–70
Linder JA, Meeker D, Fox CR, et al. *JAMA* 2017 318(14):1391–1392

Peer Comparison

"You are a Top Performer"

You are in the top 10% of clinicians.
You wrote 0 prescriptions out of 21 acute respiratory infection cases that did not warrant antibiotics.

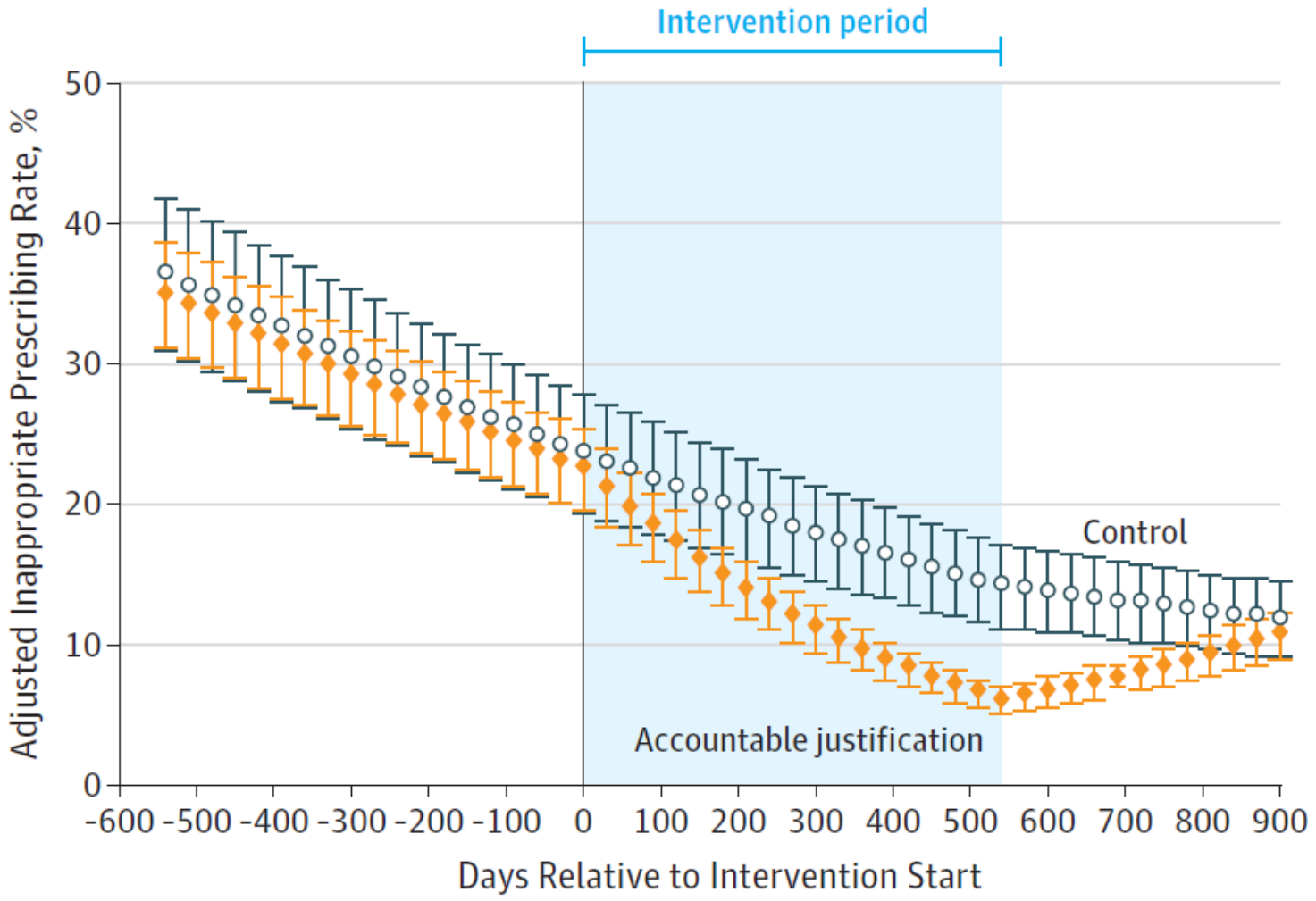
Meeker D, Linder JA, Fox CR, et al. *JAMA* 2016 Feb 9;315(6):562–70
Linder JA, Meeker D, Fox CR, et al. *JAMA* 2017 318(14):1391–1392

Accountable Justification and Peer Comparison

- **Design:** practice-clustered, randomized controlled trial
- **Setting:** 47 primary care practices with 248 clinicians
- **Primary outcome:** antibiotic prescribing for non-antibiotic-appropriate diagnoses
- **Timing:** pre-intervention, intervention, and post-intervention periods

Meeker D, Linder JA, Fox CR, et al. *JAMA* 2016 Feb 9;315(6):562–70
Linder JA, Meeker D, Fox CR, et al. *JAMA* 2017 318(14):1391–1392

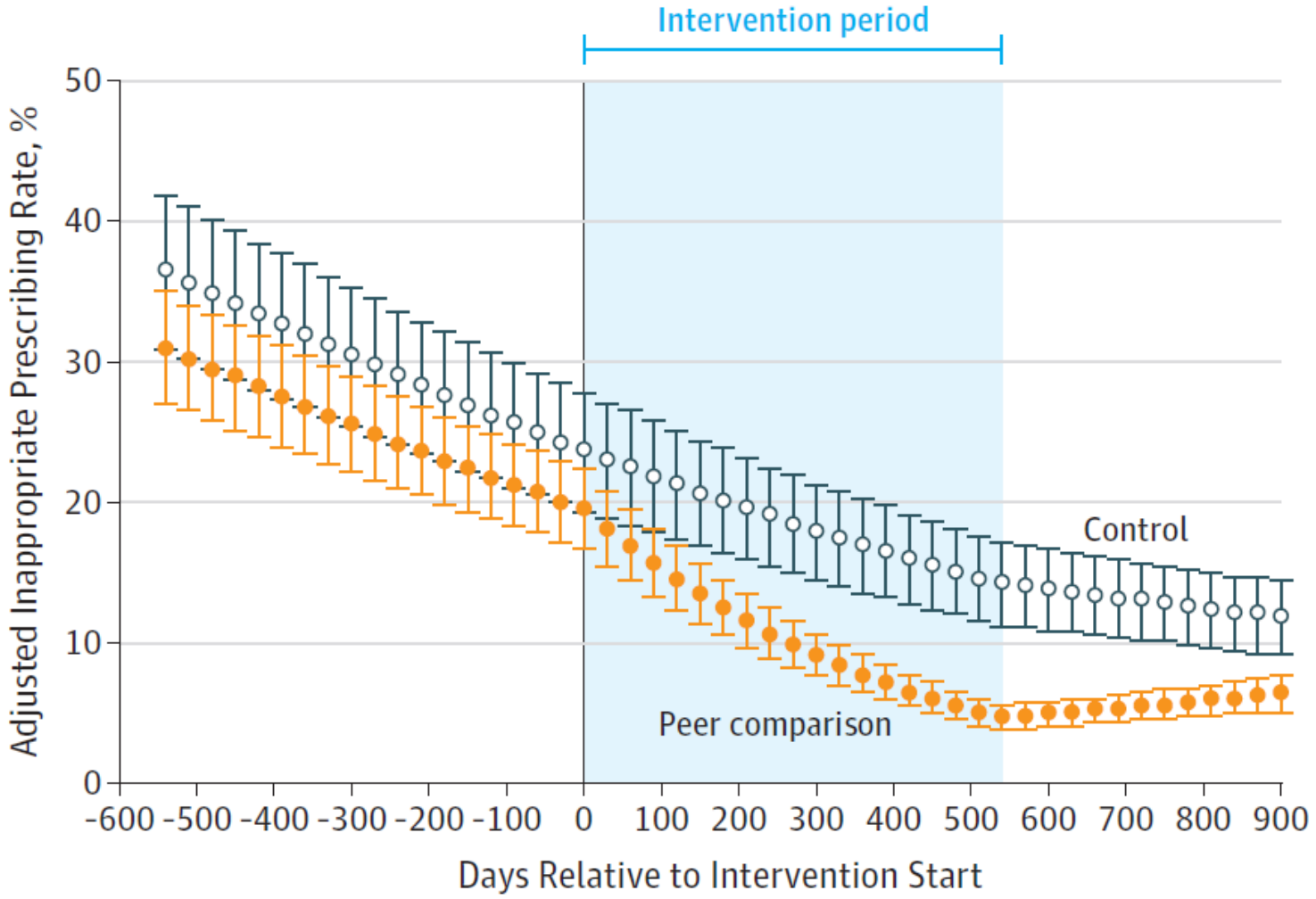
Accountable Justification: Results



Meeker D, Linder JA, Fox CR, et al. *JAMA* 2016 Feb 9;315(6):562–70

Linder JA, Meeker D, Fox CR, et al. *JAMA* 2017;318(14):1391–1392

Peer Comparison: Results



Meeker D, Linder JA, Fox CR, et al. *JAMA* 2016 Feb 9;315(6):562–70

Linder JA, Meeker D, Fox CR, et al. *JAMA* 2017;318(14):1391–1392

Summary

- **Targets for Improving Antibiotic Use**
  - Where?
  - Who?
  - For What?
- **Effective behavior change: insights from behavioral science**
  - Decision fatigue
  - Precommitment
  - Accountable justifications
  - Peer comparison

Antibiotic Stewardship Policies

David Hyun, MD

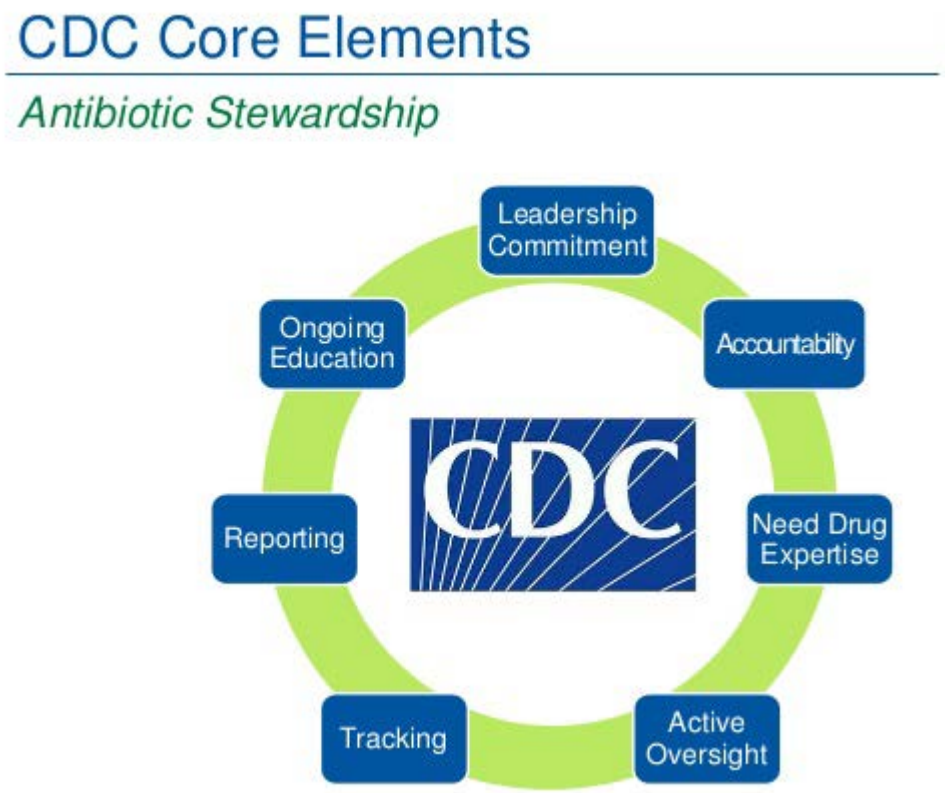
Senior Officer

Antibiotic Resistance Project

The Pew Charitable Trusts

Role of Policies for Antibiotic Stewardship

- **Promote and encourage antibiotic stewardship programs and activities**
- **National, state, and local policies**
- **Governmental and nongovernmental organizations**

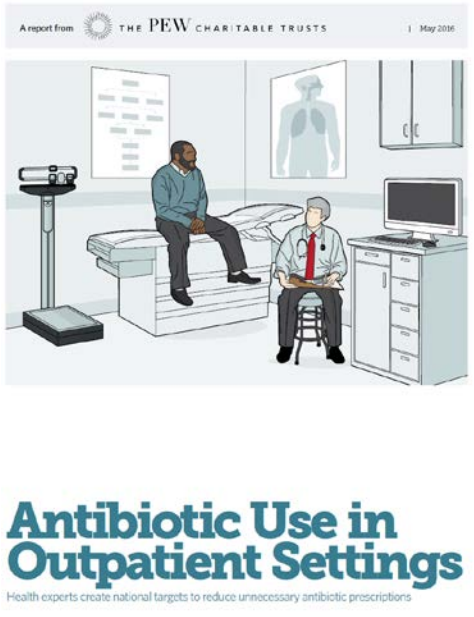


Antibiotic Resistance Project, The Pew Charitable Trusts

- Nonprofit, non-partisan, nongovernmental
- Develop policy solutions about antibiotic innovation and stewardship for human health care and animal agriculture policy
- Conduct research to identify need, feasibility, and sustainability of stewardship policies
- Gather stakeholders to identify collaboration opportunities and using public–private partnerships
- Communicate to policymakers and public

Antibiotic Stewardship Policies for Specific Healthcare Settings

- Acute care hospitals
- Long-term care facilities
- Outpatient settings



California Policies for Antibiotic Stewardship

- **California: First to legally require acute care hospitals to implement antibiotic stewardship programs**

2006

"Require that general acute care hospitals develop a process for evaluating judicious use of antibiotics, the results of which shall be monitored jointly by appropriate representatives and committees involved in quality improvement activities"

2014

"…implement an antimicrobial stewardship policy in accordance with guidelines established by the federal government and professional organizations."

"…multidisciplinary antimicrobial stewardship committee…"

"…at least one physician or pharmacist who is knowledgeable about the subject of antimicrobial stewardship…"

SB-361

California Department of Public Health (CDPH)

- **CDPH Licensing and Certification Program assesses compliance through licensing surveys**

- **California Antibiotic Stewardship Initiative**
  - Develop and refine definitions and components of hospital antibiotic stewardship programs
  - Provide resources and support for hospitals implementing antibiotic stewardship programs

Missouri Policies for Antibiotic Stewardship

- **Missouri – State Bill 579, 2016**
  - Requires antibiotic stewardship programs in acute care hospitals
  - "…evaluating the judicious use of antibiotics, especially antibiotics that are the last line of defense against resistant infections."
  - Requires facility-level antibiotic use and resistance reporting into the National Healthcare Safety Network

SB-579

National Policies for Antibiotic Stewardship

The Joint Commission

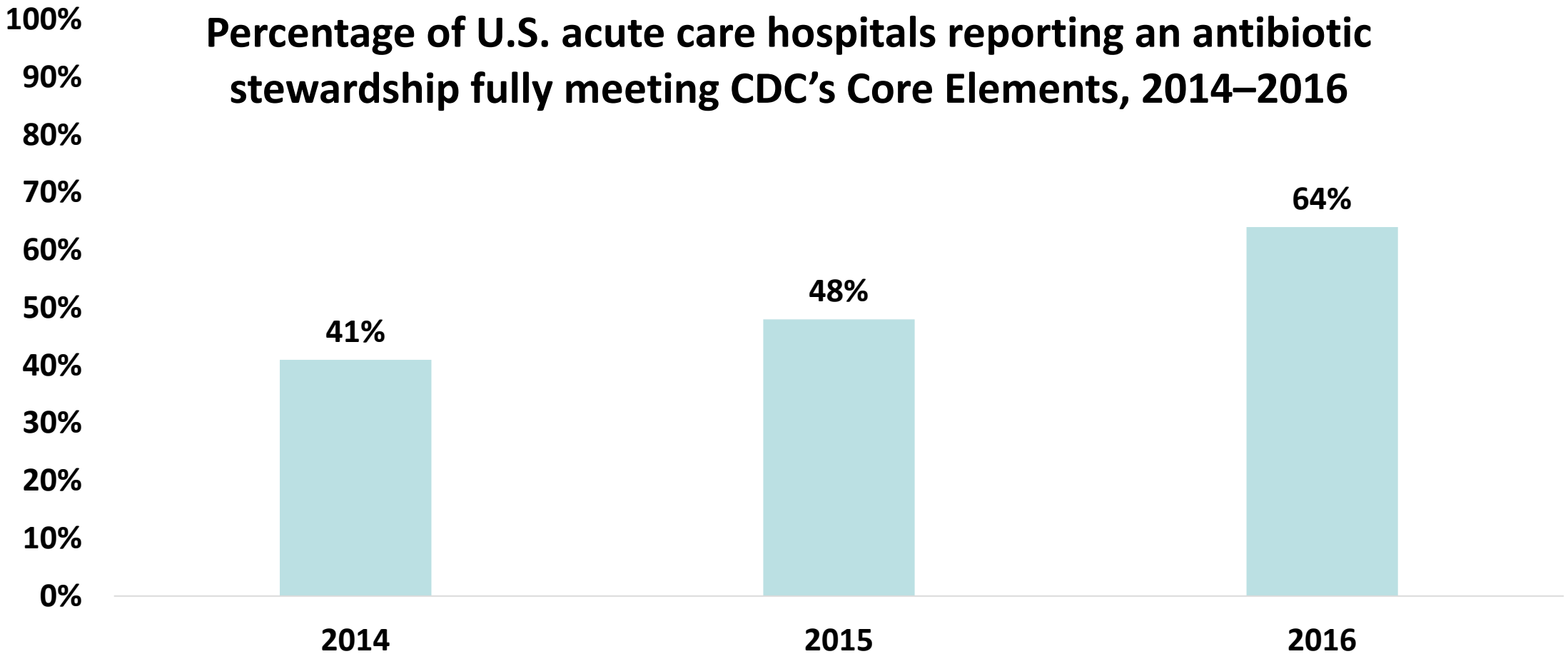
- Accredits 77% of U.S. hospitals
- Beginning in January 2017, new standards requiring antibiotic stewardship programs applied to accreditation surveys for acute care hospitals, critical access hospitals, and nursing care centers
- The standards align with the CDC's Core Elements for Hospital Antibiotic Stewardship Programs

National Policies for Antibiotic Stewardship

- **The Joint Commission Antibiotic Stewardship Standard**
  - Prospective tracking of survey results specific to the stewardship standards
  - Collection of feedback from surveyors and hospitals
  - Continued adjustments and refinement of standards and survey metrics

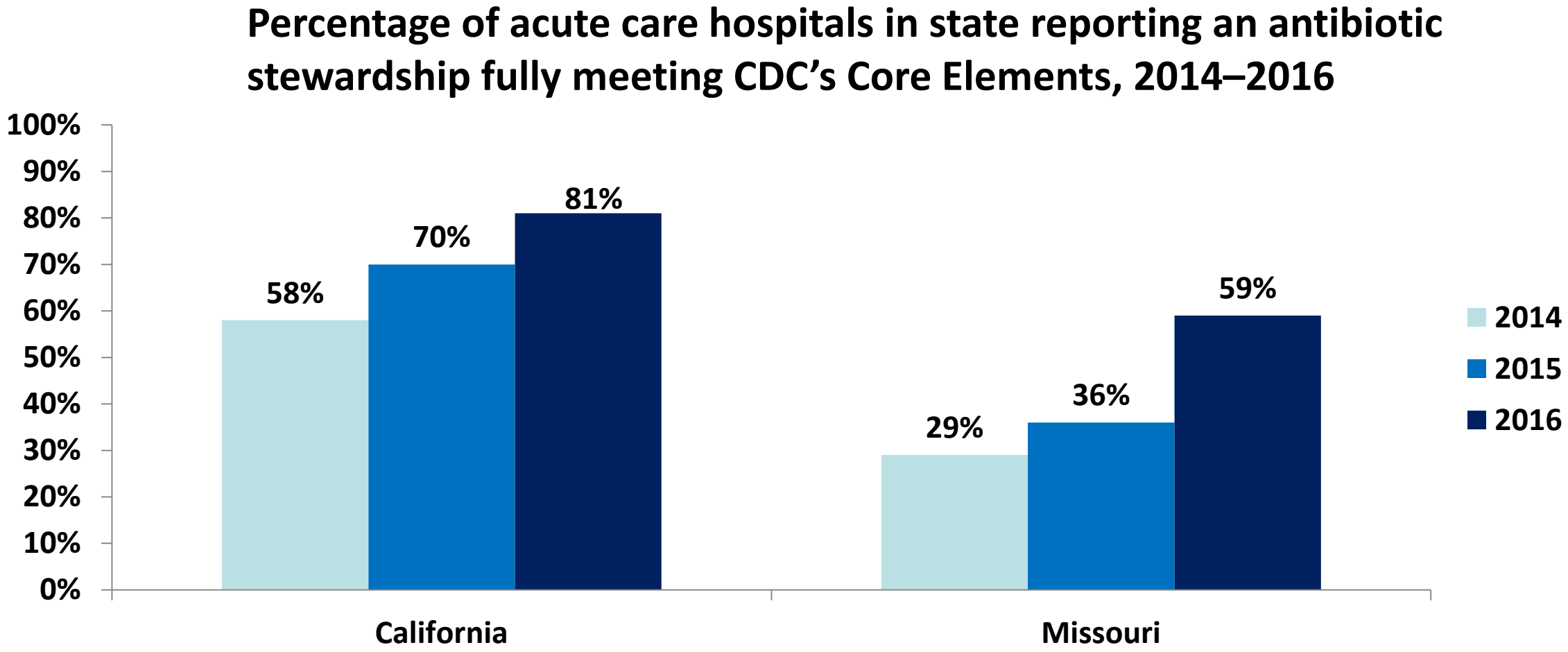
www.jointcommission.org/assets/1/6/New_Antimicrobial_Stewardship_Standard.pdf

Progress in Hospital Antibiotic Stewardship Programs



Inpatient Antibiotic Stewardship Data from CDC Antibiotic Resistance Patient Safety Atlas
gis.cdc.gov/grasp/PSA/indexST.html

California and Missouri Antibiotic Stewardship Programs

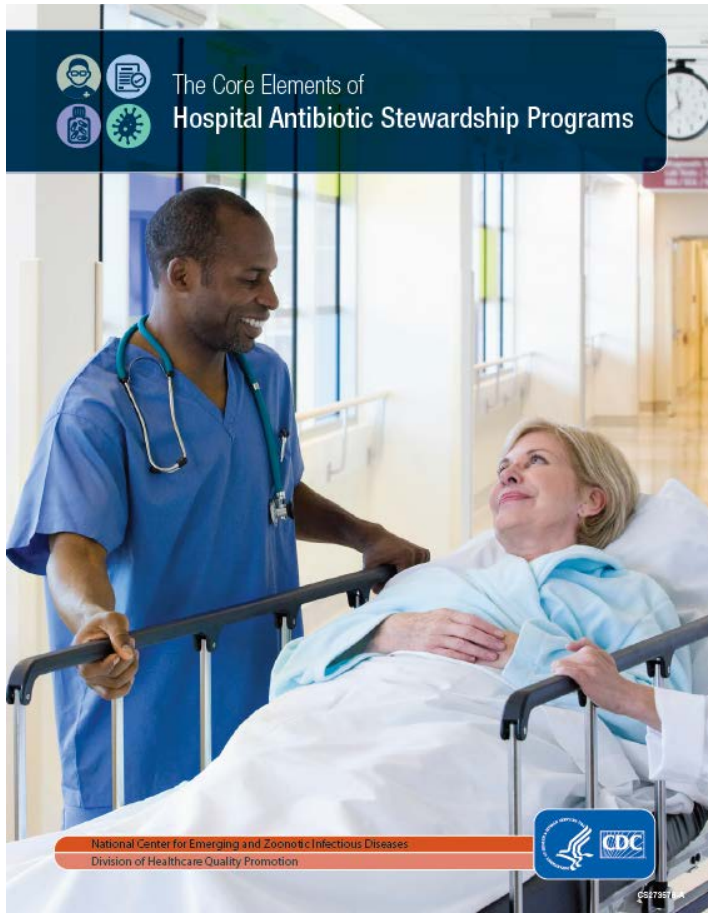


Inpatient Antibiotic Stewardship Data from CDC Antibiotic Resistance Patient Safety Atlas
gis.cdc.gov/grasp/PSA/indexST.html

Core Elements of Antibiotic Stewardship

Value of CDC's Core Elements in policy making

- Provide a baseline consensus among the various stakeholders when developing policies
- Maintain consistency across the various policies developed and implemented
- Reduce the likelihood of creating additional or contradictory requirements among the various policies



Hospital and Outpatient Core Elements for Antibiotic Stewardship

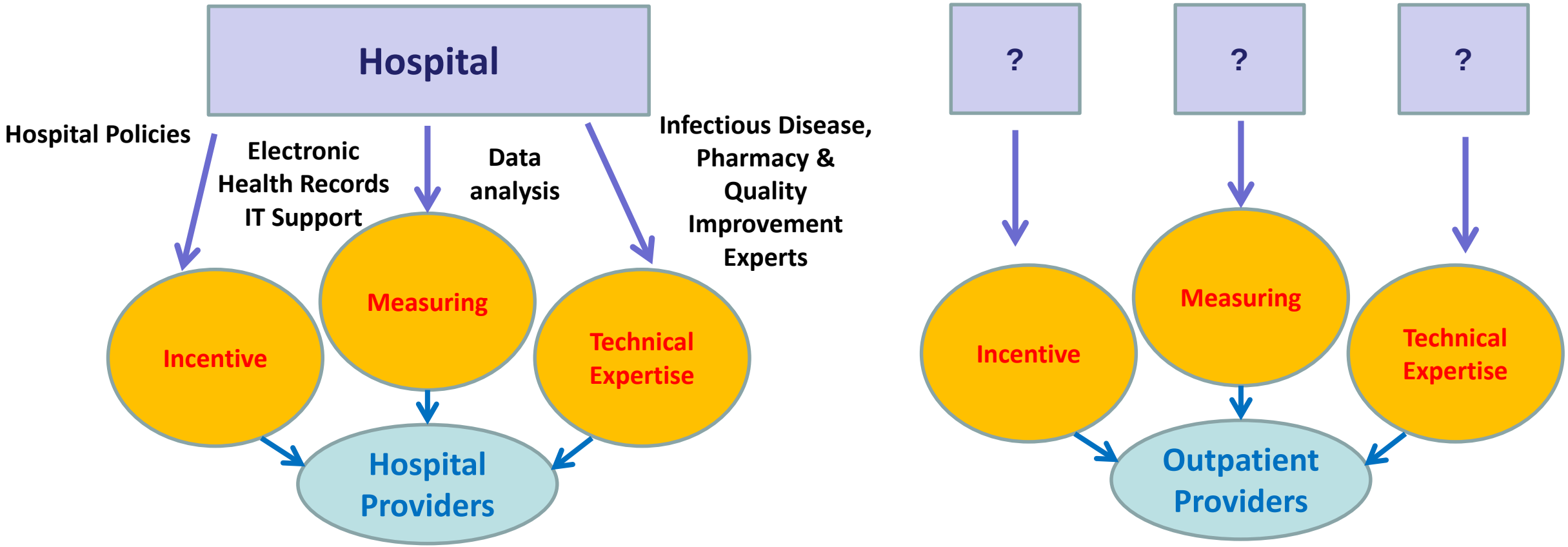
Hospital Core Elements

- Leadership commitment
- Accountability
- Drug expertise
- Action
- Tracking
- Reporting
- Education

Outpatient Core Elements

- Commitment
- Action for policy and practice
- Tracking and reporting
- Education and expertise

Translating Stewardship from Hospitals to Outpatient Settings



Aetna Antibiotic Prescriber Outreach Program

- Analyzed claims data
- Identified 1,115 clinicians who prescribed antibiotics to at least 50% of patients with acute bronchitis
- Sent letters signed by chief medical officer and included CDC's guidance on acute bronchitis management

news.aetna.com/2017/07/aetnas-outreach-tackle-antibiotic-resistant-bacteria/

American Academy of Pediatrics
Judicious Use of Antibiotics Pilot Project

- **Collaboration with CDC**
- **6 pediatric practices in Virginia**
- **Quality Improvement project to**
  - Reduce antibiotic use for viral upper respiratory infections
  - Improve appropriate use for otitis media (middle ear infection)
  - Educating families
- **Insurer incentivized participation through rewards**
- **Demonstrated improvements in prescribing**

www.aappublications.org/news/2018/01/26/Chapters012618

State Level Outpatient Antibiotic Stewardship Activities

- **Illinois Department of Public Health: Precious Drugs and Scary Bugs**
  - Commitment poster display in exam rooms
  - Education webinars

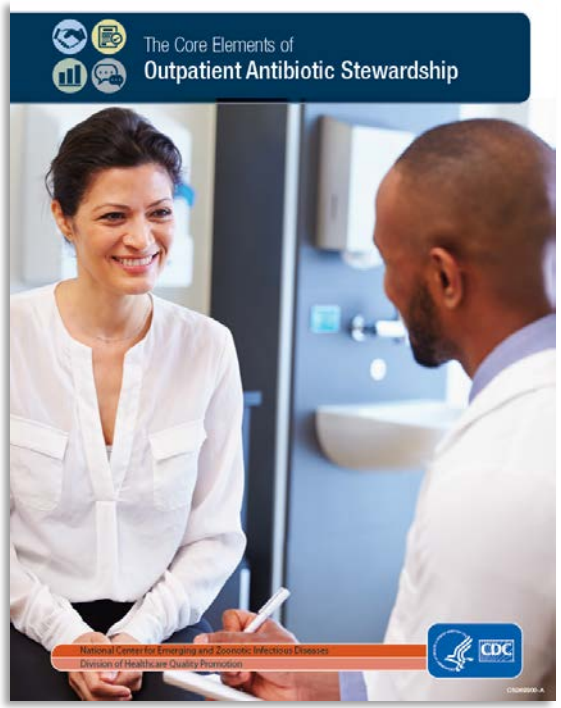
- **Utah Department of Health**
  - Public sharing of antibiotic prescribing rates for acute bronchitis by clinics
  - Analyzed from All Payer Claims Database

www.cdc.gov/antibiotic-use/stewardship-report/pdf/stewardship-report.pdf

Quality Innovation Networks and Quality Improvement Organizations

- **Centers for Medicare and Medicaid Services (CMS) tasked the QIN-QIOs to implement CDC's Core Elements of Outpatient Antibiotic Stewardship**

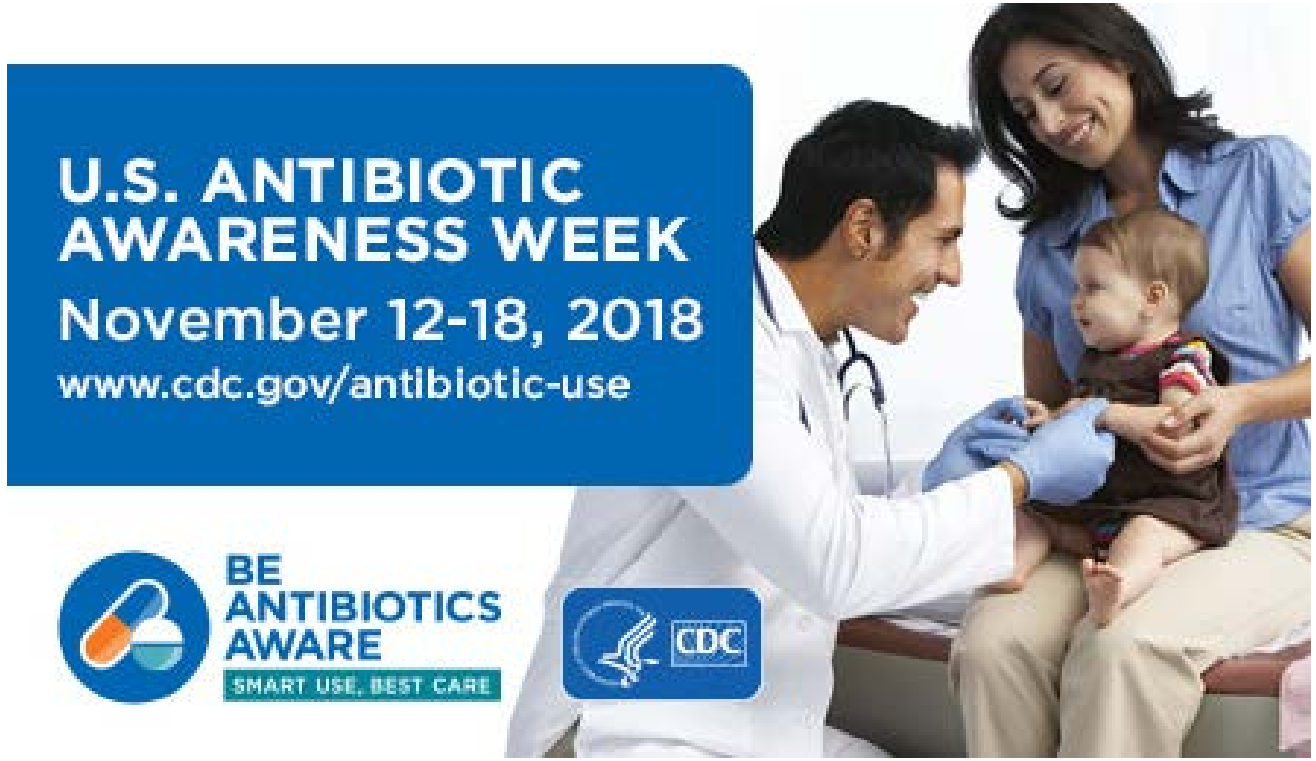
Total Recruited Facilities	7,629
Physician practices	5,948
Hospital Emergency Departments	748
Standalone Emergency Room/Urgent Care	470
Others	463



CMS data as of January 2018

Outpatient Antibiotic Stewardship

- **Developing comprehensive policies for outpatient antibiotic stewardship**
  - Assessing the resource and capacity gaps at the provider or practice level
  - Identifying stakeholders best positioned to fill the resource gaps
  - Identifying incentives for providers and practices to adopt antibiotic stewardship



www.cdc.gov/antibiotic-use

Be Antibiotic Aware: Smart Use, Best Care




May 15, 2018

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention